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HOT TECHNOLOGY
DSL: Bargain Bandwidth /p72

NOTES 5.0:
Well-Webbed Interface /p33

5 WAYS TO CUT
Computing Costs /p65

news/ NEW LOW-COST VPNs reviews/ PUSH SOFTWARE, APPLE POWERBOOK G3, AND MORE

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June 1, 1998

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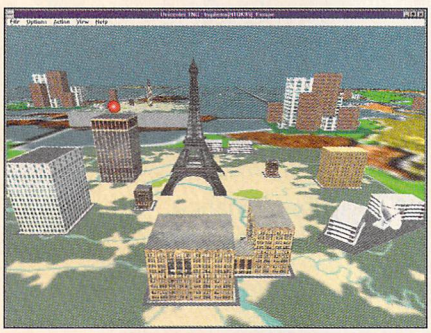
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COVER STORY

July 1998, vol. 23, no. 7

BUILDING NETWORK APPS

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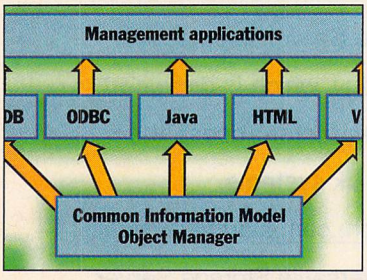


52

*By Edmund X. DeJesus*

**It's closer than you think. It's bigger than you think. It's worse than you think. Here's what you can do about the Year 2000 problem in what time remains.**

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**Managing PC Costs**
65

*By Mike Hurwicz*
Controlling ownership costs is the newest rage in hardware and software solutions.

NETWORK INTEGRATION

**DSL's Devilish Details**
72

*By Scott Mace*
Think DSL Lite is the only thing anyone needs? That your neighbor will have the same bandwidth as you? Guess again.

MANAGING DATA

**Building Web Information Systems**
80NA 1

*By Colin White*
Integrating structured and semistructured data is the key to a broad, usable data warehouse.

RESELLER

**Maximizing NT Security**
88C

You can implement many of Windows NT's underused security features to increase system protection.

**Selling Bits with Electronic Software Distribution**
88K

ESD enables anyone to sell packages on-line and make money in the process.

## EDITORIAL

12

## INBOX

15

## WEB PROJECT

**Building NNTP Groupware**
81
A few deft lines of Perl, NNTP, and HTML can take you a long way.

## JAVATALK

**Inprise's JBuilder—Take 2**
85
The latest iteration of this Java RAD environment has clever embellishments.

## FUTURE VISION

**Computers with Attitude**
87
Siemens scientists are working to endow technology with emotional intelligence.

## CHAOS MANOR

**The Days of Ninety-Eight**
111
Jerry visits WinHEC, and lives through another month of misadventures, rescued this time by old standby Norton Utilities.

## LAB REPORTS

HARDWARE

**Thin's In: 20 LCD Monitors for Your Desktop**
90
*By Russell Kay*
Our tests will help you decide if it's time to replace your CRT.



SOFTWARE

**When Push Comes to Serve**
98
*By Barry Nance*
We examine data distribution solutions for forgetful administrators and information-hungry clients.

## EVAL

GROUPWARE

**Browsing Through Notes**
33
Lotus employs CORBA and native HTML to turn Domino and Notes into a universal Web platform.

V.90 MODEM

**V.90 Modem Sets a Standard**
37
3Com/USR's Sportster 5686 connects at V.90 and is compatible with X2 and K56flex.

BACKUP SOFTWARE

**Network Backup That Users Will Like**
38
Stac's Replica Network DataManager changes our notion of network-based backup.

## REVIEWS

HAND-HELD PCs

**Computing Out of Your Palm**
103
*By Michelle Campanale and David Essex*
We compare eight of the latest palm-style and keyboard-based hand-helds.

MAC NOTEBOOK

**The Most Powerful Notebook**
107
*By Tom Thompson*
Apple's PowerBook G3 combines workstation performance with long battery life.

WORKGROUP SERVER

**A Server with Headroom**
110
*By Barry Nance*
Dell's PowerEdge 2300 is a workgroup server that's hard to outgrow.

## CORE

OPERATING SYSTEMS

**Real Time Goes Mainstream**
39
*By Bob Friesenhahn*
New additions to the Posix APIs allow you to write programs that can handle real-time processing.

NETWORKS

**S/MIME: E-Mail Gets Secure**
41
*By William Stallings*
An extension to MIME will provide security and protection from tampering.

CPUs

**PowerPC Does Blazing Vectors**
43
*By Tom Thompson*
Motorola's AltiVec technology provides vector and SIMD operations, has its own dedicated execution unit, and operates on 128-bit quantities.

PROGRAMMING

**ECMAScript: The Holy Standard?**
47
*By Rick Dobson*
An international version of JavaScript can ensure that your scripts will work properly with any browser that supports this standard.

DATABASES

**Moving Mission-Critical Apps to the Web**
49
*By John Fomook*
An application server provides a reliable middleware solution for deploying transaction applications on the Internet.

## BITS

Better Notebook Screens 20
VPNs for Small Businesses 21
MMX Alternatives 26
GartnerGroup Report 28
Future Office 32

## WHAT'S NEW

139
IBM's ThinkPad 600, monster workstations, a funky desktop machine, simple drawing software, and a translation tool for Web sites.

## IMPROBABLE

144
*By Marc Abrahams*
A mouse that uses satellite technology, and lessons in high tolerance.

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**Product Information**
http://www.byte.com/hotbytes/

**Index to Advertisers**
Alphabetical Order 136
Editorial Index by Company 138


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# CONTENTS BY PLATFORM

## WINDOWS


**Notebook Screens to Get Bigger and Better** ..... 20
Portable PC makers are continuing to trim the size of notebooks while squeezing bigger displays into less space.

**Fast Ink-Jet Takes on Lasers** 24
HP's new 2000C could be the most important printer of the year.

**Chip Vendors Out-MMX Intel** ..... 26
AMD, Cyrix, and IDT/Centaur have agreed on a standard, a non-Intel standard, for 3-D graphics extensions.

**Windows Terminal Server Gets a Hand** ..... 30
Third parties are adding capabilities to Microsoft's thin-client product.

**Webified Office** ..... 32
We ask Microsoft's manager of Office applications about the future of the software suite.

**Computing Out of Your Palm** ..... 103
BYTE tests hand-held PCs, including the spanking-new palm-style organizers based on Windows CE 2.0.

**Thin's In: 20 LCD Monitors for Your Desktop** ..... 90
Is there a flat-panel display in your future? Our tests will help you decide.

**The Days of Ninety-Eight** 111
Fireball, Chaos Manor's dual Pentium II server, is laid low by Windows 98. Plus, Dr. Pournelle makes the trek to the Windows Hardware Engineering Conference.

**What's New** ..... 139
IBM's ThinkPad 600 combines the power of the 760 and the portability of the 560. Plus, Lernout & Hauspie's Coronado deBabelizes the Web.


## MACINTOSH


**PowerPC Does Blazing Vectors** ..... 43
Motorola's AltiVec is an innovative processing technology that could significantly boost the performance of imaging, engineering, and scientific tasks.

**The Most Powerful Notebook** ..... 107
Apple's PowerBook G3 is like a prayer answered: plenty of horsepower, long battery life, and a wide array of I/O ports.


## DATABASES


**Moving Mission-Critical Apps to the Web** ..... 49
A new server architecture called an application server acts as an intermediary between thin clients and legacy databases, while managing transaction control.

**Year 2000 Survival Guide** . 52
How to cope with the impending disaster heading for Earth.


## JAVA


**Inprise's JBuilder—Take 2** 85
Javatalk looks at the latest version of this RAD tool from the company formerly known as Borland.


## NETWORKS


**VPNs for Small Businesses** 21
New products will make it more affordable for small companies to take advantage of virtual private networks.

**GartnerGroup Report: Telecommuting Traps** ..... 28
Analysts suggest 10 ways to avoid trouble.

**Windows Terminal Server Gets a Hand** ..... 30
Products from Citrix, SCO, and others will patch some of the holes in Microsoft's thin-client solution.

**A Perl for Web Developers** 30
Lincoln Stein's *Official Guide to Programming with CGI.pm* belongs on every Perl programmer's bookshelf.

**Browsing Through Notes** .. 33
Lotus Domino/Notes 5.0 uses a redesigned GUI and CORBA-based applets to distribute Notes groupware applications to any browser.

**Network Backup That Users Will Like** ..... 38
Incremental, disk-based backup and user-enabled file restoration make backup really usable.

**Real Time Goes Mainstream** ..... 39
Extensions to the Posix standard support real-time needs such as timing, scheduling, and messaging.

**S/MIME: E-Mail Gets Secure** ..... 41
William Stallings explains how this proposed standard can protect your Internet e-mail from eavesdroppers.

**ECMAScript: The Holy Standard?** ..... 47
By writing to this version of JavaScript, you can ensure that your scripts will work properly with any browser that supports this scripting standard.

**Managing PC Costs** ..... 65
While managers get better ways to measure PC ownership costs, manufacturers fine-tune their manageability features.

**DSL's Devilish Details** ..... 72
Without a broad, deployable standard, Digital Subscriber Line will remain a fractured technology.

**Building NNTP Groupware** ..... 81
Combining NNTP with HTTP and HTML, we create a help-desk application.

**When Push Comes to Serve** ..... 98
We evaluate eight push server products to determine how well they help administrators distribute file, Web, and other content.

**A Server with Headroom** 110
With 400-MHz Pentium IIs, Dell's reasonably priced PowerEdge 2300 server can support burgeoning workgroups without bogging down.

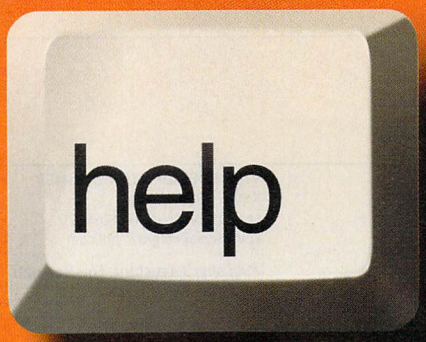

# INDEX


ADSL ..... 72
Application servers ..... 49
Application suites ..... 32
Backup ..... 38
Chips ..... 26, 43
Cost management ..... 65
Databases ..... 49, 52
Data distribution ..... 98
Development tools 33, 47, 85
Digital Subscriber Line ... 72
Display technology ... 20, 90
Distributed computing 81, 98
DSL Lite ..... 72
ECMAScript ..... 47
Future technology ..... 87
Groupware ..... 33, 81
Hand-held PCs ..... 103
HTML ..... 81
Ink-jets ..... 24
Internet/Web ..... 21, 30, 32, 33, 47, 49, 81, 87
Java ..... 47, 85
LCDs ..... 90
Linux ..... 15
Middleware ..... 49
MMX ..... 26
Modems ..... 37
Networking ... 21,26, 28, 30, 33, 38, 39, 41, 49, 65, 72,81, 98, 110
NNTP ..... 81
Notebooks ..... 20, 107, 139
Objects ..... 33
Operating systems ... 39, 111
Perl ..... 81
Programming . 33, 52, 81, 85
Quantum computing ..... 24
Real-time computing .... 39
Scripting ..... 47
Security ..... 41
Servers ..... 26, 110, 111
S/MIME ..... 41
Telecommuting ..... 28
Thin clients ..... 30
3-D graphics ..... 26, 43
V.90 ..... 37
Virtual private networks .. 21
Windows CE ..... 103
Year 2000 ..... 52



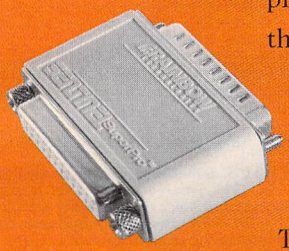


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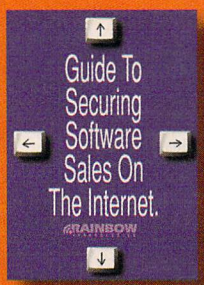



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**EDITOR IN CHIEF**
Mark Schlack
Lexington, MA, 781-860-6827
mark.schlack@byte.com

*Editorial Assistant:* Chrystie Terry
Lexington, MA, 781-860-6294; chrystie.terry@byte.com

**EDITORIAL**

**EDITOR**
Cynthia Morgan
Lexington, MA, 781-860-6298
cynthia.morgan@byte.com

**EXECUTIVE EDITORS**
*International:* Rich Friedman
Peterborough, NH, 603-924-2523
rich.friedman@byte.com

*New Media:* Jon Udell
Peterborough, NH, 603-924-2622
jon.udell@byte.com

**MANAGING EDITOR**
Jenny Donelan
Peterborough, NH, 603-924-2511
jenny.donelan@byte.com

**WEST COAST**
*Bureau Chief/Features Editor:*
John Montgomery
San Mateo, CA, 650-513-6809
john.montgomery@byte.com

**NEWS**
*News Editor:* David L. Andrews
Lexington, MA, 781-860-6296
dave.andrews@byte.com

*Associate News Editor:* Jason Krause
San Mateo, CA, 650-513-6931
jason.krause@byte.com

**REVIEWS**
*Director:* David Essex
Lexington, MA, 781-860-6299
david.essex@byte.com

*Technical Manager, BYTE Lab:*
Al Gallant
Lexington, MA, 781-860-6389
al.gallant@byte.com

*Technical Editor:* Michelle Campanale
San Mateo, CA, 650-513-6810
michelle.campanale@byte.com

*Technical Editor:* Russell Kay
Lexington, MA, 781-860-6207
russell.kay@byte.com

*Technical Editor:* Dan Tanner
Lexington, MA, 781-860-6425
dan.tanner@byte.com

*Technical Administrative Assistant:*
Robert Pickering
Lexington, MA, 781-860-6241
robert.pickering@byte.com

**FEATURES**
*Senior Technical Editor at Large:*
Tom Thompson
Lexington, MA, 781-860-6302
tom.thompson@byte.com

*Senior Technical Editor:*
Edmund X. DeJesus
Lexington, MA, 781-860-6959
ed.dejesus@byte.com

*Senior Editor:* Tom Halfhill
San Mateo, CA, 650-513-6915
tom.halfhill@byte.com

*Senior Editor:* Scott Mace
San Mateo, CA, 650-513-6833
scott.mace@byte.com

**NEW MEDIA**
*Production Associate:*
Joy-Lyn S. Blake

*Web Site Applications Developer:*
Dave Rowell

**SENIOR RESEARCHER**
Rowland Aertker
rowland.aertker@byte.com

**ASSOCIATE TECHNICAL EDITORS**
Dennis Barker, Cathy Kingery,
Warren Williamson

**PRODUCTION**
*Production Coordinator:*
James J. Perry

**EDITORIAL ASSOCIATE**
Linda Higgins
Peterborough, NH, 603-924-2689
linda.higgins@byte.com

**SENIOR CONTRIBUTING EDITOR**
Jerry Pournelle
jerryp@bix.com

**CONTRIBUTING EDITORS**
Udo Flohr, Rick Grehan,
Stella Kao, Dick Pountain

**CONSULTING EDITORS**
Stephen Apiki, Raymond GA Côté,
Robert L. Hummel, Alan Joch,
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**DESIGN** Peterborough, NH
*Acting Design Director:* Sharon Price

*Associate Design Director/Graphics:*
Joseph A. Gallagher

*Designers:* Cindy Sands,
Donna Sweeney

**VICE PRESIDENT/PUBLISHER**
Kevin McPherson
Lexington, MA, 781-860-6020
kmcphers@mcgraw-hill.com

*Publisher's Assistant:* Lois Beninati
Lexington, MA, 781-860-6126

**ASSOCIATE PUBLISHER**
Michael P. Walsh
Lexington, MA, 781-860-6714
mike_walsh@mcgraw-hill.com

*Associate Publisher's Assistant:*
Jean Tenuta
Lexington, MA, 781-860-6516

**ADVERTISING STAFF**
**(Domestic and International)**
See listing on page 137.

*Sales Support:*
Kathi Andrick, 614-899-4909

**LICENSING/ELECTRONIC REPRODUCTION**
*Copyrights Manager:*
Faith A. Ellington, 603-924-2525
fax: 603-924-2602
faith_ellington@mcgraw-hill.com

**FINANCE AND OPERATIONS**
*Director:* Jack Casey

**FINANCE**
*Senior Financial Analyst:*
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*Back Issues:* 603-924-9281
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**ADMINISTRATION**
*Human Resources Administrator:*
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## HOW TO CONTACT THE EDITORS

We welcome your questions, comments, complaints, kudos, and submissions.
**MAIN OFFICE:** 29 Hartwell Ave., Lexington, MA 02173, 781-860-6336.
**Peterborough:** One Phoenix Mill Lane, Peterborough, NH 03458, 603-924-9281.
**San Mateo:** 1900 O'Farrell St. #200, San Mateo, CA 94403, 650-513-6912.
**GERMANY/EUROPE:** Emil von Behring Strasse 2, 60439 Frankfurt, Germany, +49 69 5801 123.
**ELECTRONIC MAIL:** Send to "editors@byte.com." Most BYTE editors and columnists also have individual addresses for easy access.
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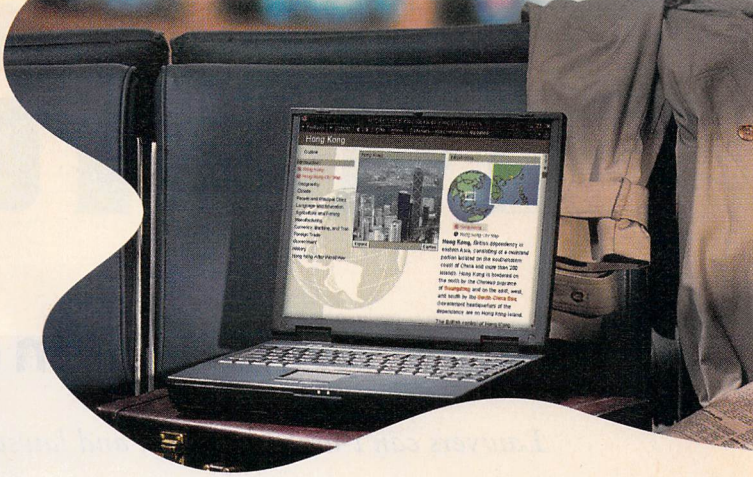
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# Weighing In on Win 98

*Lawyers can't write software, and lawsuits can't fill technology vacuums.*

This month should see the release of Windows 98, now that the U.S. government has stopped trying to halt it. I'm all for ensuring fairness and competition, but the Feds are barking up the wrong tree in a misguided attempt to keep the Internet open.

The Internet Explorer (IE) fight is a definite rearguard action. Several administrations looked the other way while Microsoft leveraged the explosive adoption of Win 3.1 and then Win 95 to corner the application market. Microsoft was the kind of success story that appealed to politicians in an era when balance of payments and international competitiveness were page-one stories.

Finally, the Feds took a stand on OEM licensing practices, one I agreed with. Then, global realpolitik collided head on with its domestic cousin in the last two years as a lot of steam (read: venture capital) built up in the nascent Internet industry. Pressure mounted on the U.S. to do something, and with all the cleverness one expects from bureaucrats, they fastened on IE as a target.

We've said several times in BYTE that the future of computing depends on OSes with integrated browsers. With Win 98, Microsoft has made a start on that.

The only remaining questions are whether there needs to be diversity and whether Microsoft forbids that diversity or merely discourages it.

Our answer is that there most definitely needs to be diversity. Microsoft is the Windows company: It would gladly tell you that. It's not the enterprise-wide, mixed-environment, run-anywhere company. It doesn't have a solution for every need, even when it comes to basics such as browsers. If your requirements involve Unix, 16-bit Windows, DOS, or something more exotic, IE 4.0 is not for you.

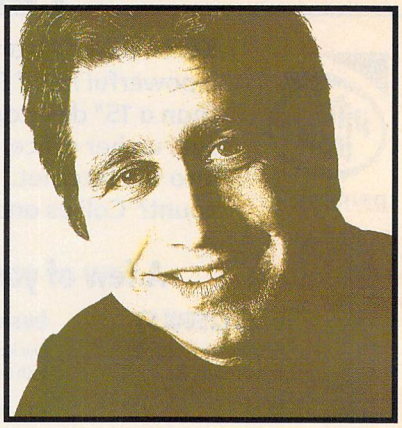
Does Microsoft forbid diversity? In all the versions of Win 98 we've seen, you can ignore IE 4.0. A little registry magic, and even the icon is gone. If I had a competitive application, I might even offer that in the installation. Meanwhile, I've had no trouble, for example, running Netscape Communicator with the Win 98 beta versions. So IE 4.0 is really not the vital part of Win 98 that Microsoft claims. Nonetheless, the company clearly works hard to make IE the de facto browser by using its clout to lock in OEMs.

What about corporations or individuals that have standardized on Communicator or another browser and want their PCs delivered with it visible, and not IE? Here, the government is right to prevent restraint of trade by making sure the door stays open to bundling other browsers with Windows, or at least shipping it without ActiveDesktop being activated. However, I fail to see the logic in mandating that Communicator be bundled with Win 98: What if I want Sun's browser? Why is a duopoly better than a monopoly?

**Microsoft's proprietary bent has given the world a clear choice when it comes to net-centric computing.**

In one way, Microsoft's proprietary bent has given the world a clear choice when it comes to net-centric computing—it's either ActiveX and Win32, or open Internet protocols combined with a development environment, which right now means mainly Java.

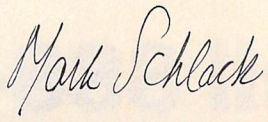
Memo to Bill Gates: If I were running Microsoft, I would never have ceded universal interoperability to every other software company in the world. Microsoft has left a huge hole for the industry to fill. I guess his response would be: "You're not the boss. I am." Well, don't say that I didn't warn you.



Memo to the rest of the software industry: Go fill that hole!

Where is the Web top that Netscape teased us with when it launched the Constellation beta a year ago? What happened to the software Oracle advertised ad nauseam on TV?

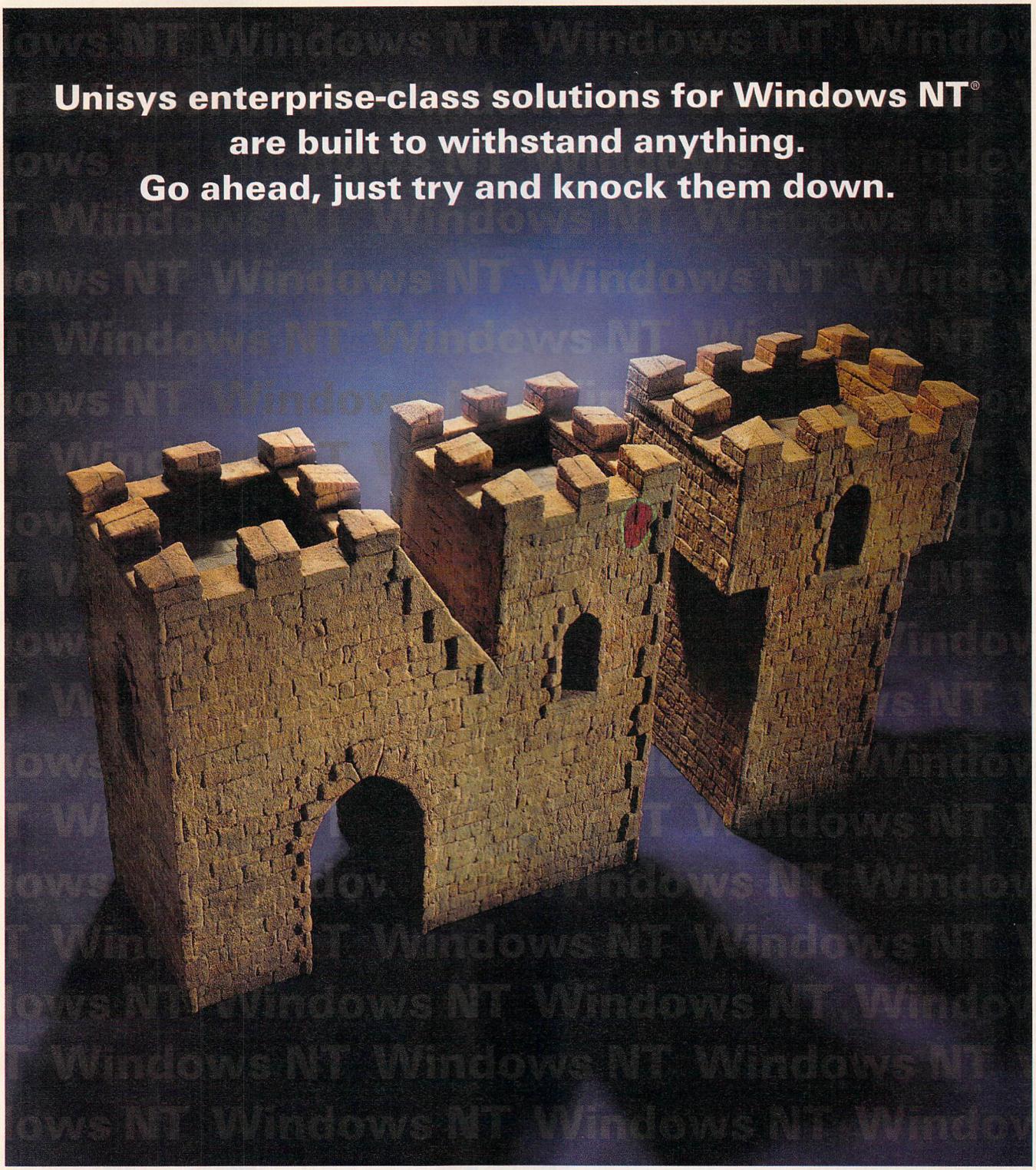
Show me how Microsoft is preventing anyone from doing a better job integrating the Internet and active content into a desktop, and I'll rail against Redmond. Meanwhile, it's sad to see companies whose success was based on play-to-win marketing now whining about having it done to them. Save the legal fees and give us what we really need: a solution for universal network computing. B



**Mark Schlack, Editor in Chief**
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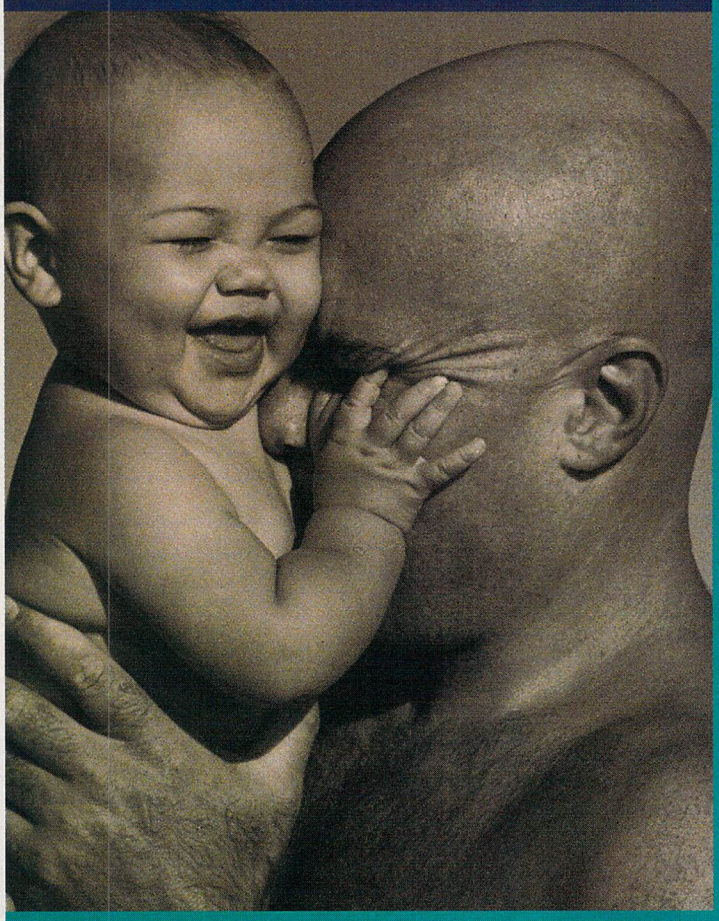
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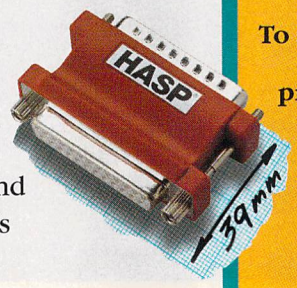
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# inbox

## Reliability Does Count

Regarding your statement in "Reliability Counts" (May Editorial), "I'm hard-pressed to think of any other piece of hardware you can buy for $3000 that's as failure-prone as a PC."; well, I'm hard-pressed to think of any piece of hardware that costs $3000 that can do anywhere near the number of things that a PC can, and with incredibly cheap added cost for the software!

*Pete Stoppani*
*pstoppani@msn.com*

*That depends on your perspective. But my bottom line is that it's time to re-examine the whole idea that PCs are unreliable because they're versatile. And apparently our readers agree. Our April cover story "Crash-Proof Computing" generated more mail than any story in recent memory. Read on.—Mark Schlack, editor-in-chief*

## See, We Told You

I have answered many of the questions dealt with in "Crash-Proof Computing" so many times that my clients are beginning to think that I am just giving them a load of BS. It's great to be able to point to an authoritative source—BYTE—and say, "See, I told you!"

*Robert Schuett*
*President, CMT Systems*
*Calgary, Alberta, Canada*
*schuett@cmt.net*

## No Reliable Criteria

I applaud your recently declared enthusiasm for PC reliability. As the manager of information systems in a medium-size municipal government, I have always emphasized reliability in my purchasing decisions. The problem is how to differentiate the good from the bad. What objective criteria exist? The trade press almost exclusively emphasizes raw performance. I am starting to see more emphasis on technical support, but maybe if the products were more solid to start with, we wouldn't need to rely so heavily on that. Couldn't we all use those hours spent hanging on the phone in a much better way?

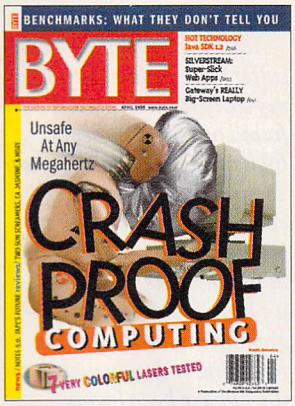
*Henry Kalb*
*Kalb@Allentowncity.org*

"Crash-Proof Computing" was worth a whole year's subscription. Great article, with great visuals to support it. I've passed it on to several colleagues, most of them very knowledgeable about computers. Uniform response: a really good overview of a serious problem.

*Ace Allen, M.D.*
*Editor,* Telemedicine Today
*http://www.telemedtoday.com*

## Mission Critical

I love PCs. I can live with some of the drawbacks because I recognize the PC for what it is. But in my area—industrial control—




*mission critical* means if the computer fails, you have a disaster. Over the years I have seen the PC creep into that environment, put in with only one thought—saving money. The software has gotten buggier, downtime has increased, and unnecessary risks are taken to keep things going.

I could not agree with you more that shortcuts have been taken in PC design to achieve its price level. I also cannot believe that we are telling people to install as little software as possible. Is not that what a computer is designed to run?

*Andrew L. Winter*
*St. John's, Newfoundland, Canada*

*I agree that things are getting out of hand. We're already talking about what kinds of follow-up articles we can do. We're even kicking around the idea of a new benchmark program that will deliberately try to crash a system, so we can obtain hard data about reliability. I'm dubbing this program the "CrashMark." We don't know if we can do it in a way that's fair, but we're looking into it. —Tom R. Halfhill, senior editor*

## No Screamers

Fortunately for myself and other readers, BYTE doesn't lead with cover pages touting the latest 333-MHz screamers. Instead we got "Crash-Proof Computing." As the leader of a small team managing the implementation and support of more than 130 Intel, RS/6000, and Sun servers, the concept of crash-proof computing is dear to my heart. I am painfully aware of many of the issues you described, their underlying causes, and remedies. Your work in


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putting these issues together with direct reference to the technology, design purpose, and directions was excellent.
*J. Dennis King*
*jdennisking@ibm.net*

## The Mainframe Perspective

As a software engineer who has worked on both sides of the fence, I take exception with the statements in "Crash-Proof Computing" that "anyone can write software for PCs" and "not just anybody can program a mainframe." Mainframe programs are just as likely to suffer from code bloat as their PC cousins, because on mainframes and midrange systems, system resources are usually not at a premium. I have seen many mainframe programs that had blocks of code endlessly repeated in the main routine, rather than put into a subroutine. It is very true that on the PC side a huge amount of code has been written by amateurs. The many tools for nonprogrammers encourage companies to use fledgling programmers rather than hire a professional. Things are really no better on the mainframe side. Many companies, faced with programmer shortages, are hiring people to do mainframe programming and conducting extensive "on the job" training. The myth persists that mainframe programmers are better trained and more skilled than their PC counterparts. The reality is that programming on any platform requires a high degree of skill and intelligence.
*John Cahill*
*jcahill@scc911.com*

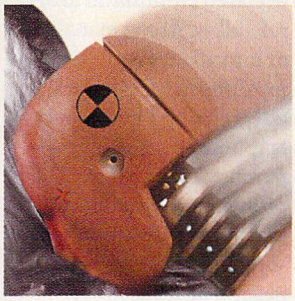
*I'd still argue that it's a lot easier to start hacking away with Visual Basic on a PC than it is to write code for an IBM S/390. Also, anybody who writes a program for a PC can easily distribute it as freeware or shareware on the Internet, which isn't how mainframe software is typically distributed.*

*Yes, mainframes, too, can suffer from code bloat. After my story went to press, I found out the number of lines of code in IBM's OS/390: 25 million. That's a lot of code, but it's still less than NT 5.0, and about the same as Windows 98, from what we hear. However, the programmers who wrote that repeating code you mention might have been highly skilled! "Inlining" code instead of using a subroutine makes the code larger, but it executes faster because the CPU doesn't have to branch as often. In fact, some optimizing compilers will automatically inline your code, even if you don't write it that way. Of course, it's also possible that the code you saw was simply written by a bad programmer. We definitely agree on your final point: Programming requires skill and intelligence. —T.R.H.*

## More Code Bloat

In "Crash-Proof Computing," author Tom R. Halfhill say that Windows NT 5.0, which will have an estimated 27 million to 30 million lines of code, represents about a 700 percent growth in code size in six years. What exactly do these millions of lines of code represent? Do they include user-space code, such as the user interface, system commands, etc.?
*Andy Kahn*
*kahn@zk3.dec.com*

*I asked that question, too, and the general answer was, "It's everything we consider to be part of the OS." In other words, more than the kernel, but nailing it down in more detail is almost impossible. In fact, most OS vendors I contacted couldn't even quote me a number. Since Microsoft is arguing to the Justice Department that Internet Explorer 4.0 is an integral part of Windows 98,*



*I guess that would be included, too. Gets fuzzy, doesn't it? But the actual number of lines is perhaps not as significant as the overall trend. —T.R.H.*

## Linux = Robust OS

"Crash-Proof Computing" avoided comparisons of the robustness of different operating systems. My main workhorse machine runs Linux. It never crashes. And from what I've heard, my experiences are typical of Linux users. Your readers need to know that there are choices in OSes that are virtually crash-proof. Switching to Linux may not solve everyone's problems, but it clearly excels in robustness. Isn't that what your article was about?
*Rob Scala*
*New London, CT*
*rob@scalas.com*

*I had planned a chart that showed how frequently different OSes crash, but I soon discovered that reliable data is not available. There's a lot of anecdotal evidence, but that's not the same thing. I did mention Linux (and Unix in general) as an OS that has more modern features, such as preemptive task scheduling. But Linux is not a simple OS to install or configure. That is why I said it "flunks the simplicity test." It may not always flunk. I'd like to see more transparent installation and configuration, and there is progress in that direction. But anyone who thinks Linux is suitable for the average person obviously doesn't spend much time around the average person. The bottom line is that we need OSes for PCs that not only are reliable, but also are easy enough for the average PC user to manage. No current OS passes that test, I'm afraid. —T.R.H.*

## Don't Trust Anyone Under 30

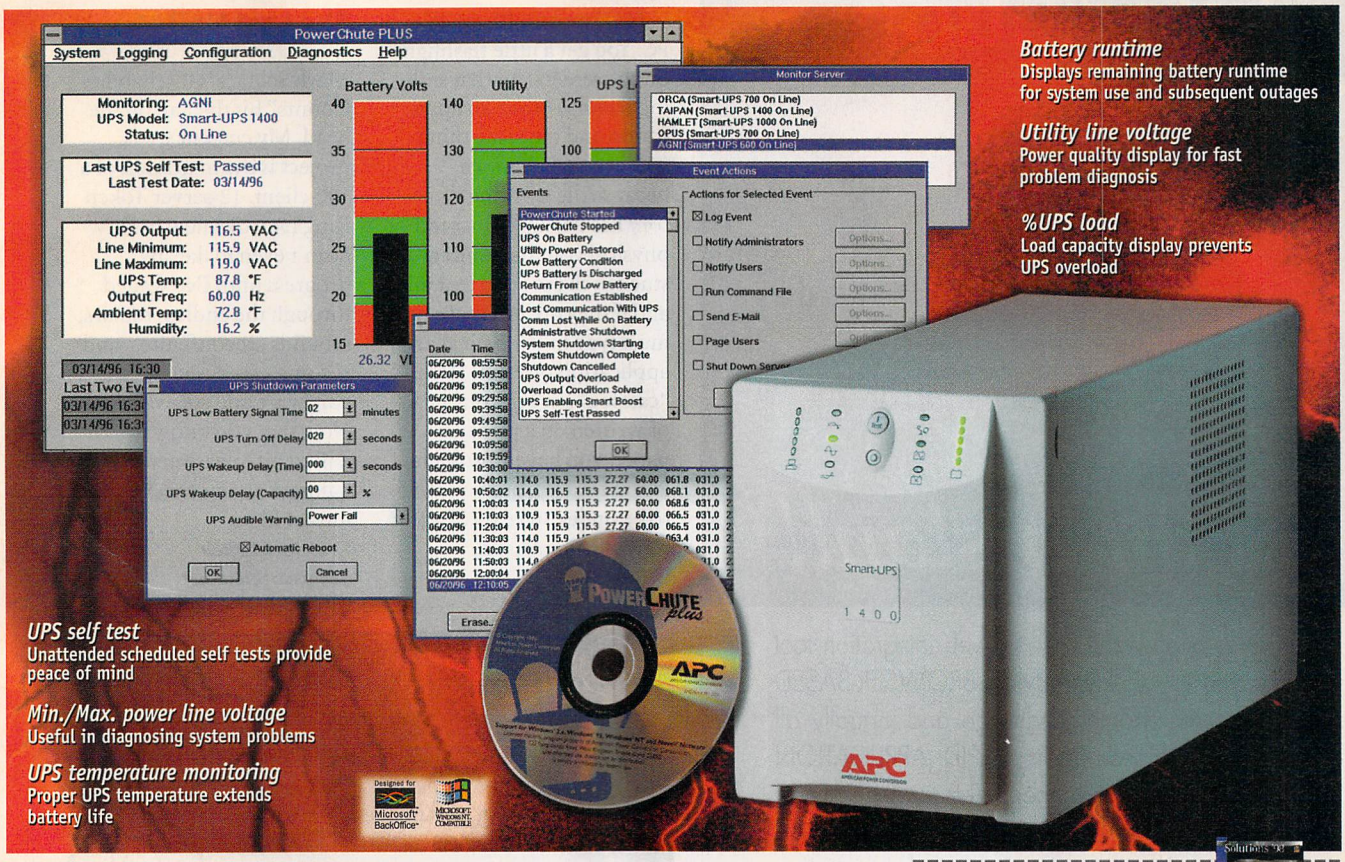
"Crash-Proof Computing" was too good! It is this sort of professional, no-nonsense reporting that makes BYTE so worthwhile.

As much as I enjoy my PCs, I often have the impression that they and their operating systems were designed by young people who somehow missed out on the entire history of computing technology. One example: Under MVS we had a system catalog, a central repository of every file name in the complex and where it resided physically. Any application that wanted a file asked the OS; the OS looked in the catalog and gave the application a pointer to the file. If you changed the physical location of a file by any method, the catalog was automatically updated by the OS unless you explicitly specified otherwise. If you deleted or created a file, the catalog was updated. Re-

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–PC Magazine

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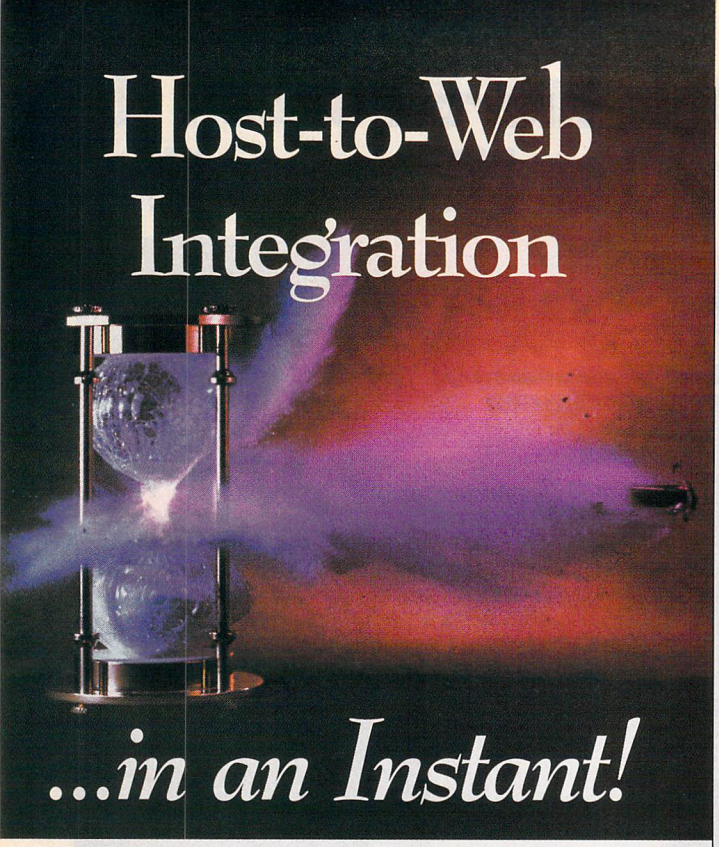
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installing applications, moving them or even putting in a whole new OS made no difference.

Now move a file on the PC. You get a little flashlight on the screen and that sinking feeling. Move an application and the same thing will probably happen because the working directory has changed. Incredibly, physical volume pointers are stuck in the properties table, and if they are not there, you must type in the path at an application prompt. If the "catalog" isn't in your head or written on a piece of paper, you have a problem. PCs are useful, but you have to be under 30 years of age to be really impressed.

*Garth Klatt*
*Softek Research*
*73642.1620@compuserve.com*

## The Last Nail

Mark Schlack's "Reliability Counts" hit the nail on the head. My current work project is the migration of a 100-client, 12-server Token Ring LAN to a new facility. I can't even make any progress until I've waded through the endless repairs, rebuilds , reconfigures, and reconnects caused by bad hardware and software. Now that you know which nail to hit, please get as big a hammer as you can and keep hitting it!

*Crawford Leitch*
*itch@earthlink.net*

## COMING UP IN AUGUST

FEATURE
### Computers Everywhere
Breakthroughs in chip density are giving rise to new classes of intelligent devices, from smarter pagers to information appliances. BYTE outlines the impact on programming and system development.

NETWORK INTEGRATION
### Router or Switch?
Can't decide between super-fast but semi-intelligent switches and slower, smarter routers for your network? Now, new developments in terabit routers are bringing speed and intelligence together in a surprising way.

BUILDING NETWORK APPLICATIONS
### Componentized Applications
Componentization is making it easier for developers to write applications around commercial software. What does the change mean for today's programmers and tomorrow's corporate applications?

SOFTWARE LAB REPORT
### Free Unixes
We test Linux and FreeBSD to see how they measure up against their commercial cousins as servers and development platforms.

HARDWARE LAB REPORT
### 350- and 400-MHz Deschutes PCs
The BYTE Lab tests a flight of the fastest new Intel-based desktop systems for power users.




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# Notebook Screens to Get Bigger and Better

*And prices for notebooks will continue to drop.*

Tired of looking at that dull, skimpy notebook screen display as you try to get real work done? Take heart: Bigger and better notebook displays will become more commonplace this year. But manufacturers and analysts caution that designing a notebook demands a series of compromises: What's perfect for one user may be unacceptable to another. And a notebook with a big screen that satisfies your desktop needs might not be appropriate when you're on the move. Such are the perils of portability.

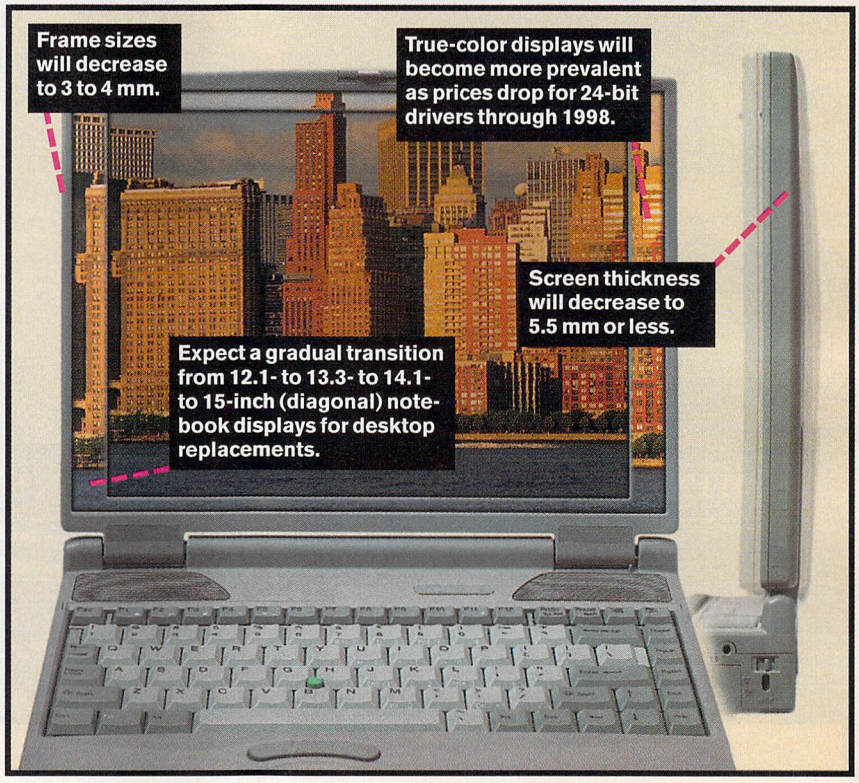
BYTE Research recently asked 150 BYTE subscribers to tell us where notebooks don't measure up to desktops, and the component they singled out the most often was the notebook display. Users also found plenty of room for improvement in terms of prices (for more information, see May BYTE, page 32).

Over the last year, improvements in display technology have yielded clearer images, the practical elimination of ghosting, and better color depth. David Mentley, vice president at Stanford Resources (*http://www.stanfordresources.com*), a market research firm specializing in electronic displays, says users can expect to see a continued, evolutionary improvement in screen brightness. You can also expect increased availability of 24-bit screens capable of 16.7 million colors (good enough for applications like Photoshop that prefer true color) and a gradual migration to bigger screens from 12.1- to 13.3- to 14.1- to 15-inch displays through 1998 and into 1999 in the desktop replacement category.

Satisfying certain market segments requires a delicate balancing act on the part of the notebook makers. Desktop-replacement customers may move around within a facility but don't often go on the road. They want the biggest screen size, best peripherals, and the most power—and they're willing to accept the consequent weight. Road warriors, such as field service personnel, value smaller size and weight enough to trade them for screen size and processing speed.

"We segment customers into two markets: consumer retail and corporate," says Ron Vitale, senior director of product marketing at Hitachi PC. "And within the corporate environment, we have to accommodate both the desktop-replacement market and the road warriors."

For the desktop-replacement market, the current standard is a 13.3-inch XGA display, but many vendors, such as Gateway with its Solo 9100 XL, have or will soon release notebooks with 14.1-inch TFT screens, which have about the same usable area as a 17-inch desktop CRT monitor. Some vendors, such as MetroBook Computer with its DT notebook, offer portables with 15-inch XGA displays. Manufacturers have been able to push display size up without making the notebooks wider by making the display frames smaller, but if the frames get too thin, the display becomes more prone to breaking. To compensate, notebooks must get wider. For example, MetroBook's DT is 1.3 inches wider than the




**Users complained about notebook displays in a recent survey, but manufacturers are working to improve screens in several ways.**

PHOTOGRAPH: STEVEN GREENBERG © 1998

company's model with a 14.1-inch screen. Stanford Resources' Mentley says frames that are just 3–4 mm wide are state of the art, and he doesn't think they will get much smaller. Gary Elsasser, vice president of worldwide product planning in Toshiba's Computer Systems Group, doesn't see much of a demand for notebooks with displays that are bigger than 14 inches because that size offers a viewable screen area equivalent to what most users have on their desktop today. "Larger-size screens equal more weight," Elsasser says. "A notebook with a 15-inch screen has a monstrous footprint. The screen makes the notebook wider and deeper. A notebook that big may not even fit in your airplane seat."

Still, manufacturers may try to push the envelope. "Hitachi is working on ways to give bigger screens," said Vitale. "There are ways to decrease that border," he said, hinting at a new display technology Hitachi is developing.

According to Bob Levin, vice president of Portable Computer Systems at NEC, thin is in. NEC's new quarter-inch-thick LCD, which uses strong but thinner polycarbonate plastic to provide support for the glass, is expected to be available in NEC's Versa line this June in 12.1-, 13.3-, and 14.1-inch screens. "In the next six months, you won't see anything dramatic in terms of screen-size growth," Levin reckons. "But our new thin-display technology allows us to package a 14.1-inch display powered by a 233- or 266-MHz Pentium II processor in a package under 5 pounds and only 1.3 inches in height."

Dale Maunu, product manager for Mitsubishi Electronics America, agrees that a big focus with notebook vendors is getting the weight and thickness down. "We're doing everything we can to pull thickness and mass out of the display, because that is what's compelling to the notebook makers." Mitsubishi's latest displays, which could start appearing in notebooks later this summer, are only 5.5 mm thick for the 12.1-inch display, and 7.5 mm thick for the 14.1-inch display, while offering astounding brightness of up to 150 NITS.

As for prices, manufacturers predict a gradual decline in display costs and more rapid cuts in CPU prices. As prices fall, bottom-line-minded corporate buyers will be able to purchase more notebooks with displays that are just as big as those of desktop PCs.

**–Robert L. Hummel and Dave Andrews**

# Geek Mystique

## Airports Get More Cyber-Friendly




Nortel's new public pay phone includes an RJ-11 data jack.

**Can't wait until you get to the airport to check your e-mail or send a fax? Airports and phone booths are becoming more PC-friendly. Thanks to the efforts of companies like Laptop Lane (Seattle, WA) and Nortel (Brampton, Ontario), accessing your corporate and private data in public places like the airport is getting easier.**

**Laptop Lane was expected to cut the ribbon on the company's first namesake facility for traveling knowledge workers in Cincinnati/Northern Kentucky International Airport. Another facility is planned to begin operation in Seattle in June. Each Laptop Lane will consist of 12 to 15 office suites, each of which are about 36 square feet in size. For $8.95 a half hour, you get access to a PC with Web and e-mail access, fax, telephone (long-distance calls cost extra), data jacks, and network printer in an office with privacy. If you need tech help, a Laptop Lane Cyber Concierge will try to provide assistance.**

**Nortel's new Millennium pay phone won't provide quite the level of service and privacy as Laptop Lane, but it should make it easier to dial in from a public location. The new Millennium Multipay Multicard terminals include a smart card/debit card reader and an RJ-11 port to allow for easier access to private mail, intranets, and the Internet from a public phone booth.**

**–Dave Andrews**

# VPNs for Small Businesses

New products make it more affordable for small and medium-size businesses to take advantage of virtual private network (VPN) technology. VPNs have attracted the attention of large, distributed enterprises because they let businesses create links across public and private networks to customers, branch offices, and telecommuters for less money than the cost of a traditional private network. The choice of which VPN is best for a smaller business often comes down to how much programming you are willing to do.

One such product that you can use to build a VPN inexpensively—although you'll have to tinker with it a bit—is Microsoft's BackOffice Small Business Server (SBS). SBS delivers elements of its parent BackOffice suite, including NT 4.0 Server, Exchange Server 5.0, SQL Server 6.5, Proxy Server 1.0, fax and modem services, and a simplified administration console. Another product, Lotus's Domino Intranet Starter Pack (DISP) 2.0, includes the Domino 4.6.1 server, five licenses for either Notes or browser clients, and the SiteCreator tool for generating and managing 12 business applications. Novell has Microsoft's SBS in its sights with Net-

## Contents

HP Ink-Jet Races into New Territory 23

New Servers, and What Users Want 26

What's Next for Microsoft Office 32

Ware for Small Business (NSB) 4.11, which combines a single-site version of Novell Directory Services (NDS) with GroupWise 5.2, NetWare Multi-Protocol Router, Network Address Translator, Netscape FastTrack Web Server, and other third-party database, fax, virus, and backup products. Netscape has no small business suit; instead it partners with Concentric Network Corporation to offer Netscape Virtual Office, an online intranet center hosting private discussion, e-mail, calendaring, and other applications for a monthly fee.

Microsoft continues to upgrade NT Server, which is part of SBS, with capabilities that improve its viability as a VPN platform. The NT 4 Option Pack, Routing and Remote Access Services (RRAS) update, and Service Pack 4 add an enhanced IIS 4.0, Microsoft Transaction Server (MTS), Microsoft Message Queuing Services (MSMQ), Index Server, Certificate Server and SSL 3.0, and Point-to-Point Tunneling Protocol (PPTP), all for free if you already have NT Server.

You can upgrade Small Business Server to take advantage of NT's new tools with careful planning. RRAS lets you tunnel into a PPTP-enabled server, and then to any workstation on the internal network. However, this defeats the security provided by Proxy Server 1.0, forcing an upgrade to the 2.0 version that supports packet filtering. You'll also need to apply a new Proxy Server hotfix to repair support for multihoming (the ability to host more than one site on a server), as well as an SBS service pack to allow use of Internet Explorer 4.01. Still, the hotfix and service pack upgrades are free, and the cost of the Proxy Server upgrade is just $505, which makes this solution almost $2000 less than buying BackOffice 4.0.

The SBS solution won't be suitable for some scenarios. For example, SBS disables NT trusts between domains, limits SQL Server database size to 1GB, and does not

## Bug of the Month

### One Bad Switch Ruins the Bunch



About 2:37 pm EST on April 13, an error occurred while technicians were upgrading software on a circuit card for an AT&T frame relay switch. The switch was not carrying customer data, but the error generated a storm of administrative messages that began overloading other network switches, cascading until every node on the network was affected. As switches quickly became overloaded and stopped routing data, customer service was cut for periods ranging from six to 26 hours. AT&T was able to restore network service as it was before the crash, but pinpointing the exact cause took more than two weeks. AT&T and Cisco, maker of the failed switch, have teamed up to prevent future crashes of this nature. Cisco has addressed deficiencies in its software to prevent excessive loopback of traffic between any two switches and added a guard to prevent loopback from proliferating between multiple switches.

Though the firm will not discuss service-level agreements with customers or how much money will be lost, AT&T decided not to charge customers for frame relay service until it completed an analysis of the root cause of the outage and defined a solution. It was not until April 29 that the company announced the cause and began billing customers again. **–Jason Krause**

*Send yours to jason.krause@byte.com*

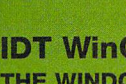
## Small-Biz VPN Solutions: Pros and Cons

| | Pros | Cons |
|---|---|---|
| **Microsoft Small Business Server** (Price: SBS five-pack, $1499; competitive upgrade, $929) | • Includes operating system<br>• Multiple servers tuned to run on single system<br>• Console and Web-based management<br>• Tight integration with Microsoft Office, Internet Explorer 4.0, FrontPage<br>• NetMeeting for help desk, application sharing, videoconferencing<br>• PPTP, SSL, IIS 4, Index Server for business-to-business e-commerce | • Complicated update, hotfix, and configuration for VPN services<br>• No bundled applications for work flow<br>• Additional cost to upgrade Proxy Server, Exchange Server, Outlook, FrontPage to current versions and integrated capabilities |
| **Domino Intranet Starter Pack** (Price: DISP 2.0 w/five clients, $1695 | • Automated installation and site creation<br>• 12 working business applications<br>• Distributed content management<br>• Roles-based security via IE/Netscape browsers<br>• Full Domino server included<br>• Replication services for automated application deployment<br>• Outbound fax service | • Applications are basic in features but complex, difficult to modify<br>• Advanced templates supporting SSL, Certificate Server can't be used without additional designer client, Notes development skills<br>• Deploying with MS Proxy Server requires both Domino and IIS running, port configuration changes |
| **NetWare for Small Business** (Price: $995, five users; competitive upgrade, $595 for five users) | • Lowest price for competitive upgrade<br>• Simplified combined installation of NetWare and GroupWise<br>• Novell Directory Services (NDS), Novell Application Launcher, Novell Easy Administration Tool (NEAT)<br>• NetWare Connect for remote access<br>• Nodal licensing | • No proxy server<br>• No SSL, tunneling support<br>• Trial 2-user network faxing<br>• No business applications |

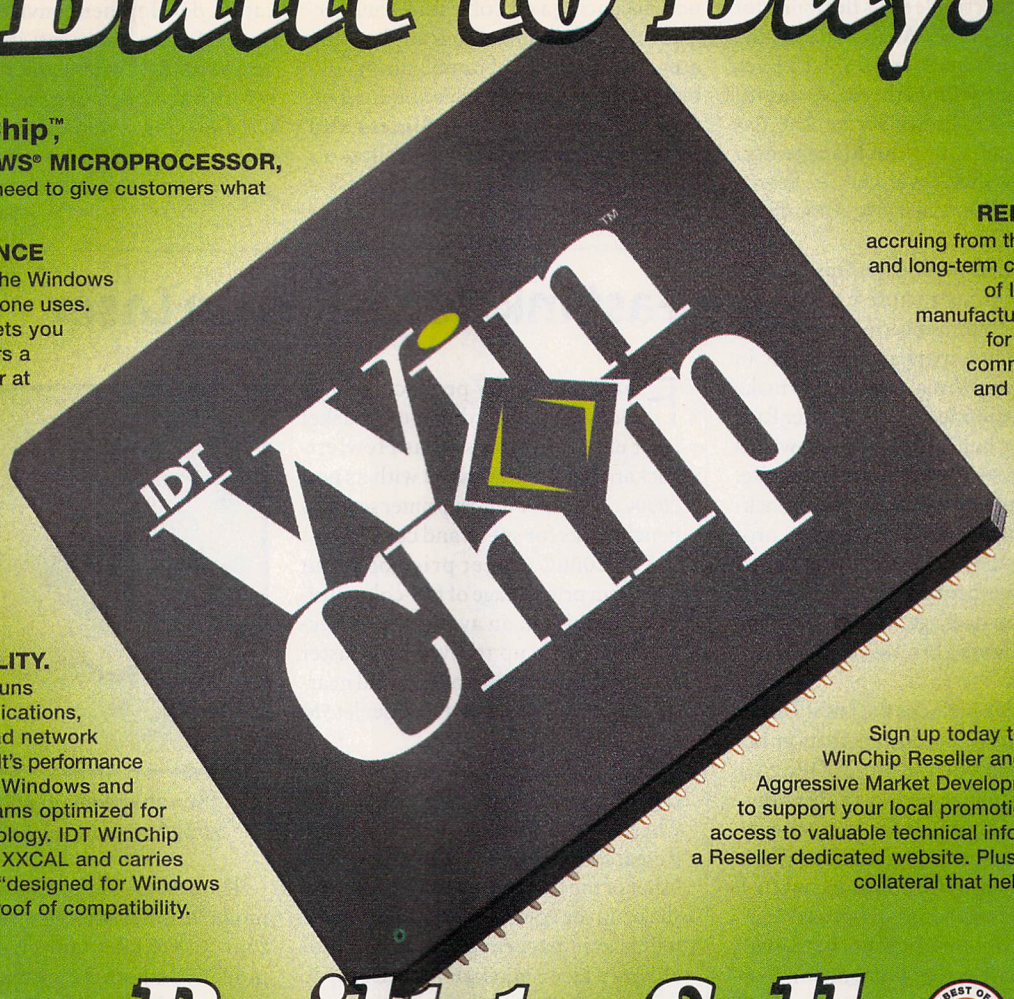
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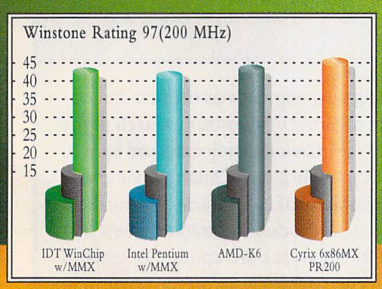

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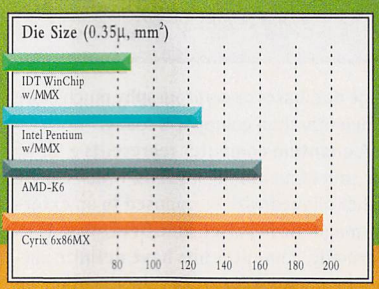
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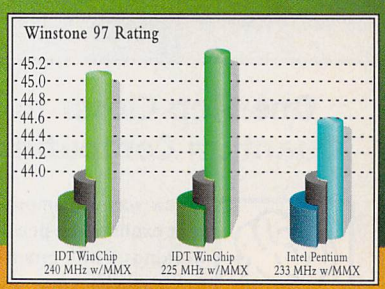
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support Exchange directory replication. These changes cripple SBS's flexibility for use in satellite offices. Microsoft is readying an upgrade path from SBS to Back Office 4.0 that will add the full version of SQL Server 6.5, Proxy Server 2.0, Exchange Server 5.5, Systems Management Server (SMS), SNA Server, and Site Server, but at press time, pricing was not determined.

While SBS, RRAS, and the Option Pack provide the infrastructure for business-to-business communications, you need programming expertise, especially in Visual Basic and Visual InterDev, to make it all work. Domino Intranet Starter Pack on the other hand, comes ready with a secure, browser-based application suite. Contact management, customer tracking, company forms, job postings, project management, registration, discussion, and document library databases are all part of the package. You can manage sites remotely via a browser or the native Notes client.

Lotus's DISP includes the latest Domino server and on-line documentation, but you'll need to buy the Notes Designer client to customize or add applications. Domino 4.6.1 comes with a Certificate Server and sample registration templates for SSL 3.0 client authentication, but DISP only uses the less-secure password technology. Multihoming will not work with SSL certificates; the work-around requires partitioning with the more costly ($1000 additional) Advanced Services version of the server.

NSB, DISP, and SBS are tactical products, balancing a mix of features and services that evangelize their underlying architectures without cannibalizing full-blown suite sales. Novell is counting on GroupWise's user friendliness and advanced document management tools to retain mind share in the face of NT's application services momentum. Lotus continues to provide a Web-based application development environment that outperforms Microsoft in its own NT backyard. And Microsoft moves steadily forward, integrating security, messaging, indexing, standards-based file formats, and directory services that the competition can't afford to give away.

**– Steve Gillmor**

# Fast Ink-Jet Takes On Laser

Finding an empty product niche in today's saturated printer market isn't easy, but that's what Hewlett-Packard has accomplished with its new 2000C. The color ink-jet printer sets new benchmarks for speed and cost.

The 2000C (street price of about $799) can print a page of full-color business graphics in an average of 43 seconds, which is up to five times faster than HP's other color ink-jets and nearly four times faster than the LaserJet 5M color laser.

"This is the most important printer introduced in the last few years," says Charles Lecompte, an analyst at Lyra Research (*http://www.lyra.com*), publisher of the *Hardcopy Observer*. "It will shake up the color ink-jet market, and it will also impact the color and monochrome laser markets." LeCompte expects color laser prices to drop in reaction but says they can't compete directly in the sub-$1000 price range.



**The networked version of the 2000C includes a print server.**

The 2000C's improvements include a modular ink system that separates the four (CMYK) ink tanks from the four print heads. Both the ink tanks and print heads are field-replaceable, improving serviceability and reducing downtime. Embedded circuitry in each component

# Future Watch

## One Step Closer to Quantum Computing



A new way of computing that exploits the peculiar workings of quantum mechanics has come closer to realization. A team led by Isaac Chuang, a research scientist at the IBM Almaden Research Center (San Jose, CA) has demonstrated a quantum search operation that found one piece of data out of four in a single step. Ordinary computer search algorithms would require an average of 2.25 steps. This demonstration of quantum computing's capabilities could portend computers that can process operations related to huge databases or cryptography much more efficiently than computers today.

A quantum computer represents a bit by the spin of an atomic nucleus, which can be either aligned with or opposed to an external magnetic field (see June BYTE, page 111). Normally, computer bits have definite values of either 1 or 0. But in the Alice in Wonderland world of quantum mechanics, the atom exists in both spin states simultaneously, the equivalent of doing two things at once. Using molecules with more than one of these quantum bits, or qubits, the number of simultaneous operations increases exponentially. Lov Grover, a scientist at Bell Labs, showed last year that a quantum computer could theoretically search an arbitrarily large database with a single query.

Chuang's experiment was the first demonstration of Grover's quantum search algorithm. Since individual molecules are hard to work with, the brain of Chuang's computer was a thimbleful of chloroform solution held within a superconducting magnet a few feet across. Radio pulses are applied to control the molecules, which work on the problem in unison. The result is detected by nuclear magnetic resonance spectroscopy.

Quantum computers will not appear in stores anytime soon. But if the miniaturization trend in electronics continues, Chuang said, the line widths of components used in PCs will be down to molecular scales by about the year 2015. "It is precisely at this regime," he added, "that quantum physics becomes important."

**– Sherri Chasin Calvo**



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reports the status of each ink tank or print head. The increase in the number of ink nozzles to 304 per color (more than twice as many as HP's DeskJet 890C) contributes directly to improved print quality and speed.

The 2000C isn't perfect. According to Lisa D'Amore, product manager for consumer products at HP, the company had to compromise on some features to get the 2000C to market quickly. "The 2000C supports PCL 3 enhanced, but not PCL 5 or PostScript," D'Amore said. "We'll be working on adding PostScript and improving ink permanence."

With a rated duty cycle of 5000 pages/month, paper input capacity of only 150 sheets (250 sheets with the optional paper tray), and a 75-sheet output tray, the printer will not replace a high-volume departmental color laser, HP admits. These limitations, and the lack of built-in connectivity (you'll need an external print server), position the 2000C as a fast color printer for two to six users in a workgroup.

A spokesman for Epson, which competes with HP, declined to comment on either the 2000C or development of fast ink-jets of its own. Catherine Stewart, communications manager at Lexmark, granted that the 2000C's print speed is impressive but downplayed its potential impact on Lexmark's printer sales. "We don't believe it competes directly with our offerings," she said. "We're below that price point with our consumer ink-jets and above that with our corporate lasers."

Analyst Lecompte says HP will have an exclusive on the fast ink-jet market for at least a year. As for other printer manufacturers, he added, "They'd better deliver competitive products or they're going to get killed."

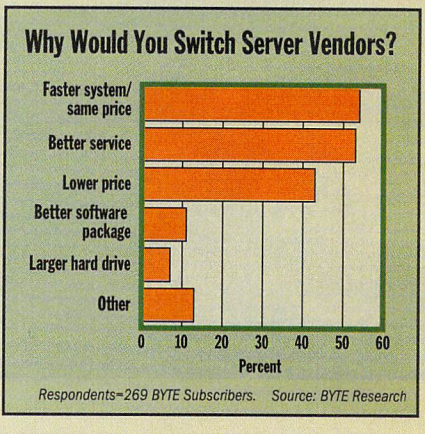
**–Robert L. Hummel**

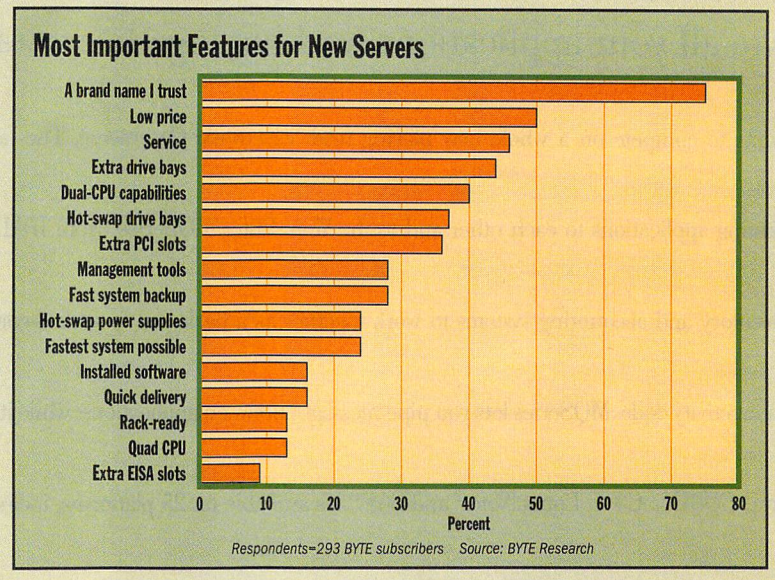
## Survey

### Server Survey: Users Value Brand Names They Can Trust

When purchasing a new server, the top consideration users look for is a brand they can trust. And if you are a server vendor, the best way to get someone to switch to your brand is to offer a faster system for the same price or offer better service, according to a recent survey of BYTE subscribers conducted by BYTE Research.

Price as a factor varies considerably depending on the size of the company. Of the respondents who work for companies with under 100 employees, 75 percent said low price was a product feature they look for when buying new servers. That number dropped to 62 percent in companies with 100 to 499 employees, and all the way down to 26 percent in companies with 500 to 4999 employees. Anything bigger (5000 + employees), price actually increased as a factor to 41 percent.




# Chip Vendors Out-MMX Intel

Three of Intel's competitors have beaten the giant to the punch with new technology. At the October 1997 Microprocessor Forum (see "Beyond MMX," December 1997 BYTE), AMD, Cyrix, and Centaur/IDT announced independent plans to extend the x86 architecture with new 3-D graphics extensions. These proprietary extensions had threatened to irreparably fracture the x86 architecture until the three companies recently agreed on a common standard, called 3DNow.

"Instead of having three different op codes, we got together and hammered out our differences," says Stan Swearingen, senior director of business marketing for Cyrix.

The new standard is based on AMD 3-D, which originally consisted of 24 instructions but has now been pared down to 21. The new extensions enhance graphics performance and 3-D gaming by improving a chip's floating-point performance, physics modeling, geometry calculations, trilinear filtering, and, to a lesser extent, video playback and sound.

The extensions are scheduled to appear early this quarter in the AMD K6



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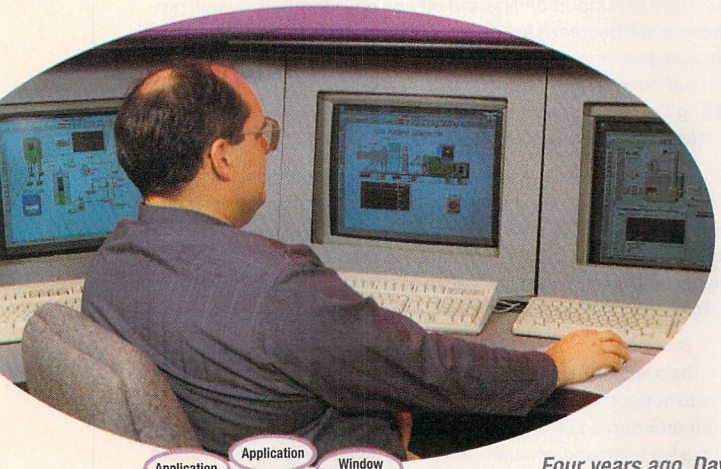
# Joe reboots his PC every day.

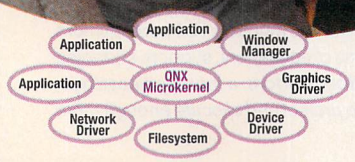
*That's a fact.*






***Conventional OS Architecture***
*The monolithic OS on Joe's machine clumps all OS components into a single address space. One subtle programming error in just one driver, and* ***whoomp!****, Joe has to reboot – again.*






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# Dave hasn't since 1994.

*That's a fact too.*

*Four years ago, Dave Cawlfield at Olin Chemicals replaced expensive PLCs with OMNX Open Control Software and the QNX Realtime OS. "Since then," says Dave, "we've upgraded the control system regularly with new hardware and software – including parts of the OS itself. But not once have we had to reboot."*

*For a handy 12-point checklist on OS reliability, download Dave's paper,* **Which OS for PC-based Control?**, *at www.omnx.com/productinfo/technical_papers.htm.*

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3-D, in the Cyrix 6x86MX by the second half of the year, and in the Centaur WinChip 2-3D, which is to ship late this month. Intel's new multimedia extensions, code-named Katmai, will not appear until 1999.

Between this new graphics standard and Intel's forthcoming Katmai extensions, Microsoft's Direct3D will be the glue that keeps the x86 standard coherent. Microsoft has announced that it will include the new standard in DirectX 6.0, to be released in July, meaning programmers can simply write to the Direct3D API to exploit the extensions. If developers don't write to Direct3D, or are writing for an OS without DirectX, they will have to include 3-D libraries in a program to take advantage of the extensions.

"This is the biggest feature advantage they [AMD, Cyrix, and IDT] have ever had over Intel," says Michael Slater, principal analyst for the *Microprocessor Report*. "But in the long run, it is inevitable that they will eventually have to support Intel's standards, too. This is a short-term victory." **– Jason Krause**

# GartnerGroup Report

## Transcend the Top Ten Telecommuting Traps

Most IS managers focus on the myriad technical details when developing a telecommuting program. However, personnel, psychological, and legal issues can overwhelm even the most technically perfect program. We discuss the top 10 reasons why telecommuting programs fail and how to prevent them. Issues are presented in reverse order of importance.

**10 Insufficient Support Infrastructure:** Because they often work extended hours or in a different time zone, teleworkers can stretch an enterprise's support infrastructure. Teleworkers cannot easily give their machines to technical support when problems arise, nor can technical support use remote-control tools to troubleshoot remote computers if the employee's problem is with remote access. **Solution:** *Train telecommuters on remote workstation configuration and maintenance before they begin to work from their home offices. Train the support staff on the remote-access environment and consider expanding the hours for which technical support is available.*

**9 Insufficient Security Policies:** Teleworkers typically require full access from home to all the system resources that would be available to them within the enterprise. But it can be difficult to validate the teleworker's identity. **Solution:** *Revise security policies to address the issues regarding employees working in a home environment (e.g., corporate use of personal computers and personal use of corporate computers should be discouraged, and sign-on and authentication procedures should be strengthened).*

**8 Union Difficulties:** Many unions feel that telecommuting interferes with their representation and collective bargaining power. **Solution:** *Approach union leaders early to construct a program that is acceptable to both the enterprise and union.*

**7 "Quantifiable" Productivity Gains Aren't Achieved:** Too frequently, the enterprise embraces telecommuting to attain a mythical 20 percent increase in user productivity. However, changes in productivity are difficult to measure; many knowledge workers don't have quantitative (or even objective) performance metrics. **Solution:** *Rewrite performance metrics for all eligible job roles to focus on objective, output-oriented metrics, and train managers to use the new performance metrics.*

**6 Teleworker Productivity Declines:** Telecommuter productivity usually declines in the first six to 10 weeks of the program's implementation. These decreases are due to insufficient training in using the remote workstation, isolation from the workgroup, and inexperience in filtering out distractions at home. The productivity decline is generally temporary but can dishearten the telecommuter (and the enterprise), leading to high dropout rates. **Solution:** *Minimize the impact and duration of the productivity decline with proper training. A telecommuter training lab can provide an excellent introduction to telecommuting, and lets employees practice setting up and maintaining remote equipment.*

**5 Overall Productivity Declines:** Without sufficient workgroup tools to support on-line and off-line collaboration, overall productivity will decrease as the workgroup disintegrates. **Solution:** *Encourage communication by publishing home office numbers and work-at-home schedules so that coworkers feel more comfortable calling the teleworkers. Longer term, modify workgroup processes to take advantage of collaboration tools.*

**4 Employee Morale Drops:** Without formal policies that define employee eligibility, available equipment, the amount of telecommuting that will be supported, and other details, a telecommuting program can result in lower employee morale. Unevenly distributed telecommuting privileges can lead to frustration. **Solution:** *Establish policies that outline eligibility requirements.*

**3 Budget Overruns:** Although many think telecommuting can help reduce operating expenses, telecommuters are more expensive to support than their office-bound counterparts. According to GartnerGroup's 1998 study of remote-access total cost of ownership, a full-time telecommuter can cost as much as 124 percent more than an office-bound worker in terms of equipment, support, and voice and data communications. **Solution:** *Perform a thorough cost/benefit analysis at the beginning of the project and allocate enough money to support the program.*

**2 Legal Morass:** When deploying telecommuting, the enterprise must ensure that it is in compliance with all local, regional, and national regulations. **Solution:** *The legal department should provide guidance in all stages of the telecommuting program and should review all telecommuting policies.*

**1 Management Reprisal:** Many telecommuting programs (even those initially driven by end-user demand) find a surprisingly small number of volunteers for the program's pilot or deployment stage. This is mostly due to employee fear that management will look harshly at people who do not work in the office. A lack of consistent productivity metrics enhances the fear that "out of sight" will mean "out of mind." Without sufficient participation, telecommuting programs tend to be canceled after about a year. **Solution:** *Managers must be convinced of telecommuting's benefits and should be trained on how to work with remote employees. Management buy-in is the single most important prerequisite.*

**Cherry-Rose Anderson (*network@gartner.com*)** *is a GartnerGroup analyst focusing on people issues of remote access and mobile computing*

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# Windows Terminal Server Gets a Hand

Many add-ons and third-party solutions are emerging for NT Server 4.0 Terminal Server Edition (WTS), Microsoft's thin-client computing solution for Windows. The most glaring deficiencies in WTS are cross-platform support (the base product supports Windows clients only), load balancing, and advanced multiuser management features. Citrix (954-267-3000), which licensed its WinFrame technology to Microsoft as the basis for WTS, addresses these issues with its MetaFrame technology (formerly pICAsso). MetaFrame offers load balancing for WTS clusters, and Citrix's ICA protocol adds Win CE, DOS, Unix, Mac, and Java support.

Other add-ons bring auditing and advanced real-time system monitoring to WTS. Lakeside Software's (248-738-1138) SysTrack, originally a WinFrame tool, adds features for applications and bandwidth usage, system resources, and user monitoring not done by Perfmon, NT's built-in monitoring tool.

An interesting supplement to WTS is SCO's (408-425-7222) Tarantella, a stand-alone product that integrates application servers and Unix, Windows, mainframe (3270 and 5250), and Java clients. Tarantella will be important to users who need to integrate legacy terminals and applications. SCO claims it scales to 50 servers and can support 10,000 simultaneous application users.

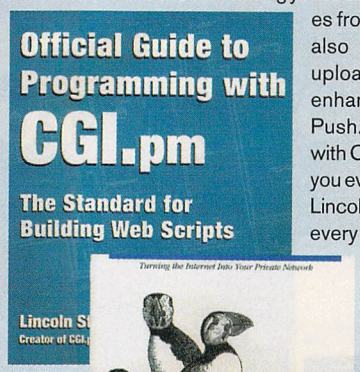
Companies are also pushing ahead with their own multiuser Windows products. Tekcentric's (408-752-8100) WinCentric and New Moon's (408-296-8500) Liftoff are currently on the market and hope to carve their own space by being fast and simpler to deploy than WTS.

As WTS matures, it will probably take over many functions addressed by third parties today. For example, load balancing may get added in NT 5.0. But then new products addressing scalability, bandwidth management, web access management, and other issues will appear. **–Jason K. Krause**

# Book Reviews

## A Perl for Web Developers

Perl developers may have access to a powerful function library and not even know it. CGI.pm has been a standard component of the Perl 5 distribution since the 5.004 release. The library stores a rich set of CGI functions for simplifying and enriching Web-based interfaces, forms, style sheets, and scripts.

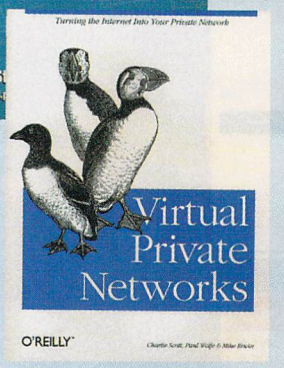



You can find documentation for the CGI.pm library scattered across the Web, but now Lincoln Stein, the creator of CGI.pm, has put together an authoritative manual for easy reference. *Official Guide to Programming with CGI.pm* defines the functions available from the library with sample scripts and an informal prose reminiscent of O'Reilly's indispensable guide *Learning Perl* by Randal Schwartz.

Perhaps the most tedious aspect of Perl is passing HTML code to the Web browser through a series of `print` statements. CGI.pm streamlines this task with functions like `start_html()`, which sends header information, title strings, and formatting codes in one fell swoop. As with any CGI.pm function, you simply define the function set from your Perl script, then call the function as you would a built-in subroutine.

CGI.pm's real power rises in the development of Web-based forms. In addition to calling functions for form input elements and submission buttons, the developer can retrieve all the CGI parameters passed to the script by calling the `param()` function or retrieve a specific parameter value by including the parameter name as an argument. Better yet, a pair of functions lets you save the state of a CGI session to an output file and restore the session when the client returns to your site. With the `cookie()` function and functions for retrieving key information about the remote session, you can identify a client who has logged in before, restore the state of the former session, and fully customize your page depending on the remote browser's capabilities.

Beyond the function-call interface, CGI.pm supports an object-oriented mode, allowing you to derive your own object classes from the module. The library also supports calls for file uploads, frames, JavaScript enhancements, and Server Push. Once you start working with CGI.pm, you'll wonder how you ever programmed without it. Lincoln Stein's book belongs on every Perl programmer's reference shelf.




Yet another barrier is falling in the wake of a ubiquitous Internet. Previously, only large companies could afford the leased lines and expensive equipment necessary to build secure WANs. But now smaller companies can build upon enterprise-wide Internet connectivity and mission-critical intranet applications and extend these technologies into secure VPNs. *Virtual Private Networks* explores the technologies and solutions that make up these Internet-based networks.

Early chapters explain the technologies involved (such as packet tunneling and encryption algorithms) and weigh the costs and benefits of VPNs against two other popular solutions: traditional WANs and remote access. Later chapters cover a representative range of specific solutions, including the shareware Point-to-Point Tunneling Protocol, the AltaVista Tunnel, and Cisco's high-end PIX firewall. The book evaluates the solutions in terms of functionality, robustness, ease of installation and management, device support, and security issues. This a solid introduction to an important enterprise technology.

**Stanford Diehl,** *formerly BYTE's reviews director, is currently a systems engineer for a large commercial printer. You can reach him at sdiehl@nebs.com.*

**Official Guide to Programming with CGI.pm** by Lincoln Stein; John Wiley and Sons, ISBN 0-471-24744-8, $29.99.

**Virtual Private Networks** by Charlie Scott, Paul Wolfe, and Mike Erwin; O'Reilly and Associates, ISBN 1-56592-319-7, $29.95.



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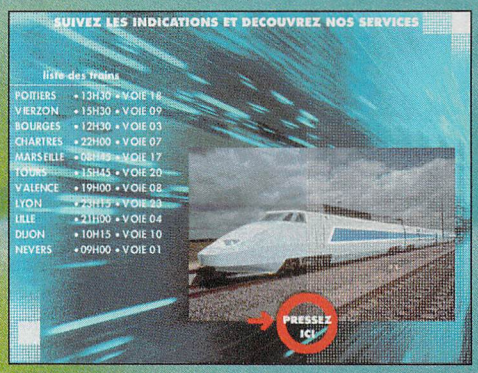
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## Blasts from the Past

**5 Years ago in BYTE**

The first Pentium-based PCs were becoming widely available on the market. The cheapest unit we reviewed for this issue sold for $8915.

**10 Years ago in BYTE**

Intel started talking about a new version of the 80386: The 386SX used a 16-bit (not 32-bit) data bus and lacked an FPU. Since it was cheaper than the 80386, Intel targeted the 386SX for "midrange" PCs.

**15 Years ago in BYTE**

Videotex services, which provided access to remote data over computer, terminal, or TV, promised a new way to communicate, purchase products, and get the latest news. Services in Great Britain and France met some success, thanks in part to government sponsorship. But some videotex services were too limited (either from a graphics or information standpoint) or were not commercially viable. We also covered the Microsoft Mouse.

**20 Years ago in BYTE**

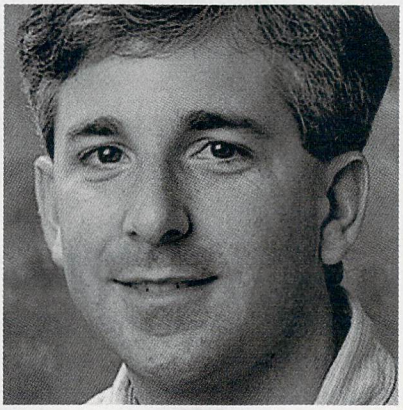
An article by Sol Libes said that the first personal computer was not the MITS Altair 8800. Libes traced the birth of the personal computer to 1966, when the Amateur Computer Society was founded and began publishing its *ACS Newsletter*. Two years later, the newsletter carried reports of members who'd built a wide range of personal computers, some with "up to 20K."




INTERVIEW

# Webified Office

*Steven Sinofsky, general manager of Microsoft's Office Desktop Applications division, talks about the future of Office.*



**BYTE:** *Microsoft is readying a new version of Office to ship later this year. What are the main goals?*

**Sinofsky:** The goals are focused on three areas: Web productivity, business-ready software, and intelligent software. Over the past year we have been working closely with representatives from many corporations that need to deploy and manage thousands of end users. This gave us special insights in how to build a release of Office that is more robust and manageable for large businesses. The next release of Office will incorporate self-repairing applications, which means that if a file is missing or damaged, you will automatically be prompted for your CD (or network location) to repair Office. This same technology allows one to install, on demand, less frequently used components of Office such as templates, wizards, or converters. Web productivity is all about leveraging the Web infrastructure—servers, HTML, HTTP, and so on—to make it so that producing rich Web documents is as easy and productive as printing to a laser printer or posting to a file server. We're going to fully support "round tripping" of HTML in Word, Excel, Access (for forms and reports), Outlook (for HTML e-mail), and PowerPoint. This means HTML is a full-fledged companion file format so everything you can do in the application today using our Office 97 binary file format can be done with HTML. We accomplish this by using standard HTML 3.2 including Cascading Style Sheets (CSS). Having support for HTML is only the first step. The next release of Office will make it as easy to save to a Web server as it is to save to a file share today by just using File Save As.

**BYTE:** *How will XML and DHTML be used in the new Office?*

**Sinofsky:** We are super-excited about these new technologies because they really allow us to leverage the browser as a first-class viewer of Office documents. First, all the Office applications will fully "round trip" HTML. This also includes HTML added through server-side process or by hand editing (for example, if you wanted to add your own comments to the page for a server process). Word, Excel, and PowerPoint documents, Access reports, and Outlook mail messages can all be viewed in any HTML-enabled browser. Of course, if you have the "fourth-generation" browsers that support CSS you will have WYSIWYG browsing and editing. We use XML to represent the private data for Office. This enables us to provide full support for the semantics of editing. For example, when you add graphics to a document, we will save out a standard GIF for the browser. But we will also save out an XML description of that graphic, which will allow you to later return and edit the graphic in the native vector format. This gives you full access to resizing, recoloring, layering, and the rich AutoShapes in Office. We will use DHTML in a number of ways. For example, when you are viewing a PowerPoint presentation in the browser, you will have full access to the transition effects and slide navigation tools. You can see the outline of the slides and expand and contract it to show the detailed bullet points. We do this through the document object model of the browsers, which is a W3C standard. We will also support Web page scripting in all the Office applications.



www.byte.com

*Lotus employs CORBA and native HTML to turn Domino and Notes into a universal Web platform.* ***By Steve Gillmor***

# Browsing Through Notes

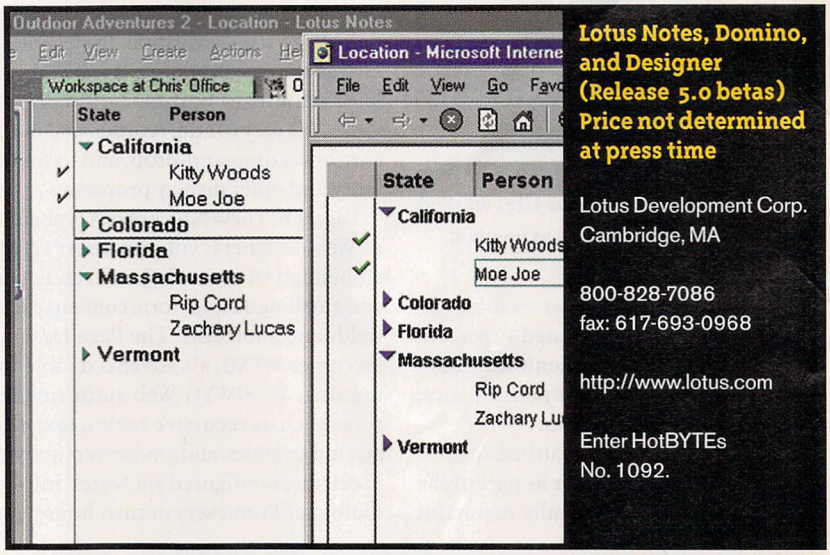
It's another cliffhanger. Can Notes, having survived the Invasion of the Browsers, beat back the Microsoft challenge? With Domino/Notes 5.0's first public beta release, Lotus is taking nothing for granted, offering powerful new tools for the fast-growing Notes installed base, Web site and n-tier client/server developers, and power users. This release delivers native HTML support, adding new Web-friendly concepts such as pages, outlines, and framesets to the Notes IDE. The enhanced tool set lets developers write a single application that will look the same on both Notes clients and Web browsers, extending Notes workflow and information management tools securely across corporate boundaries.

Release 5 completes the separation of the Domino server and Notes client into self-contained elements. Full support of Internet standards including HTTP, LDAP, IMAP, POP3, SMTP, SSL, and NNTP allows much of the rich Notes proprietary technology to be served to a broad range of clients. Lotus has drawn a line in the sand with the Notes 5 client, focusing on the Win32 and Power Mac platforms

| RATINGS | |
|---|---|
| TECHNOLOGY | ★ ★ ★ ★ ★ |
| IMPLEMENTATION | ★ ★ ★ ★ |

while offering browser-based functionality to Unix and OS/2 users.

Where Microsoft has integrated a Web browser into the operating system, Lotus has in effect done the opposite: added Notes functionality to the browser. The old client's Workspace is gone, replaced with a frames-based interface populated with HTML pages. R4.6's Favorites collection of databases—Mail, Calendar, To Do, Journal, and Personal Address Book—is now the first of a series of Bookmark folders that you can access from a navigation channel on the left side of the screen. You can drag and drop bookmarks from any displayed frame, including links to Notes documents, views, and navigators, URLs, and the underlying file system.




**Lotus Notes, Domino, and Designer (Release 5.0 betas)**
**Price not determined at press time**

Lotus Development Corp.
Cambridge, MA

800-828-7086
fax: 617-693-0968

http://www.lotus.com

Enter HotBYTEs No. 1092.

**Domino's View applet brings unique Notes client functionality to browsers, such as drilling down through the information hierarchy.**

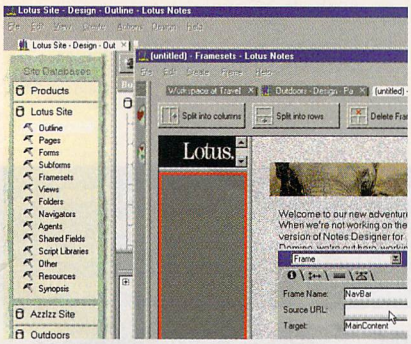
Familiar browser navigation buttons live in the upper right corner of the screen, but when you click a link, Notes ventures into new territory, opening each new page with its own autosizing tab label. Clicking a tab brings that page to the front, while clicking the small x to the right of the tab closes the page without displaying it. You can display the Microsoft Internet Explorer ActiveX control in its own embedded window if you want the traditional linear browser functionality as well.

Lotus cc:Mail migration is smoothed by key R5 mail improvements. A memo-addressing header contains long lists of recipients in a separate scrollable window; improved type-ahead addressing waits for the end of a text string or a known delimiter before resolving. Auto spelling check and a soft-delete Trash folder can catch mistakes before and after you click the Send button. LDAP V3 integration lets you search Domino public address books and foreign LDAP directories, such as Bigfoot, by company or department name. The new lightweight enterprise directory can store some 250,000 entries in a 12-MB database, speeding type-down addressing that jumps from name to name across domains and Web-based directories.

Mail preferences have been overhauled; you can use English-language syntax to set server-based mail rules with conditions and actions that copy to a folder, delete, and change the importance of messages. Notes developers will applaud a synchronous mail agent that can immediately trigger processing on newly arrived mail. Task-management features are better integrated with Notes calendaring and scheduling, with tasks flowing from day to day until you mark them com-

pleted. In general, performance has been improved by recoding the mail template's LotusScript in C.

Domino's revamped server-administration panel gathers existing and upgraded tools in a tabbed interface. You can add, delete, and move users, dragging and dropping them from one server to another. Lotus has also incorporated 80 percent of its NotesView server-monitoring add-on, letting you track server performance, availability, and event status.

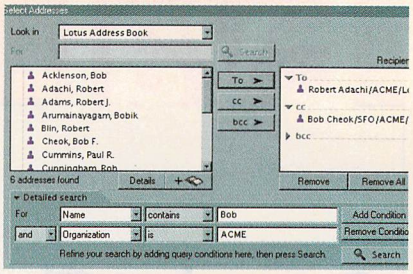



**Designer tracks the last five sites worked on, updating databases as needed.**

The Domino Designer can be launched as a separate executable or as part of the Notes client; it automatically maintains a bookmark list of the five most-recently used databases under construction. In the new HTML-aware development environment, you use the Outline tool, Page Designer, and Frameset Designer to assemble applications.

The Outline tool lets you lay out the navigational structure of your application, much like a site map in other Web-authoring packages. It has two components: one (available only to the application designer) that lists design elements and links between elements, and the other, an outline control, can be embedded in a page or form for user navigation. By default, the Designer automatically generates an outline from an existing database's folders and views. It's easy to add, reorder, and indent entries via drag-and-drop, and to set visibility and other display properties.

Pages are a new Notes object type aimed at Web designers; you can insert HTML, embedded UI controls (see Tech Focus), and anything a Notes form contains except fields and subforms. The Page Designer leverages HTML 4's advanced table formatting. WYSIWYG Web authoring features such as recursive tables, text-flow around graphics, and gradient colors within cells are configured via Notes' InfoBox dialogue. Framesets in turn house your pages; the Frameset Designer lets you set an initial configuration, split and resize frames, and apply name, source URL, border, and scrollbar properties.




**The Notes 5 client supports LDAP V3 address searches across the enterprise.**

The new release stores and renders images in native format (GIFs, animated GIFs, and JPEG), eliminating conversion routines and improving color fidelity. Notes fields have been improved for Web display, adding support for Windows-friendly visual text boxes, keyword combo and list boxes, and calendar controls.

Judging by this first look at Domino/Notes 5, Lotus continues to focus on Windows NT integration. Small businesses will appreciate the ability to run the Domino server as an ISAPI extension to Internet Information Server (IIS), using IIS as the HTTP stack in place of the Domino GO server. The product now uses the industry-standard InstallShield Wizard, and you'll find migration tools for cc:Mail, Microsoft Mail, Exchange, Lotus Organizer, and NT users. A new NT service allows NT to recognize partitioned Domino servers as separate servers, and support has been added for operating system clusters such as Wolfpack.

Missing from the public beta are advanced search capabilities touted at the LotusSphere conference, most likely the victim of a Verity lawsuit. Also yet to be delivered are transaction and logging services, though the beta does support online in-place compacting and an API for online incremental backup.

Release 5 retains Domino's lead in the groupware race by leveraging its robust programmability and integrated services. And the Notes client has become a browser on steroids, integrating mail, Web sites, and workflow apps in a seamless interface that should capture mind share. B

*Steve Gillmor* (**sgillmor@southerndigital.com**) *is a consultant with Southern Digital in Charleston, SC.*

## TECH FOCUS: OBJECTS

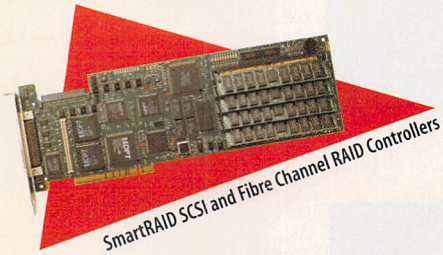
### Notes on Browsers: How Lotus Exploits Java and CORBA

**Release 5 provides two approaches to enhance access to Domino services from browsers: a set of Java applets that mimic the rich Notes client user interface (UI) and a lightweight high-speed server object request broker (ORB). With the View, Outline, and Rich Text applets, Domino designers can include constructs unique to the Notes UI in browsers that HTML can't easily handle. Among these are categorized views, hierarchies of documents, multiple selection, double-clicking, scrolling, and text formatting.**

**With existing Domino applications, clicking a view icon to expand a section forces the server to generate a new HTML page, send it back to the browser, and redraw the screen. When you embed an applet in a view and check the "Use Applet in the Browser" property, the Domino server serves up the page complete with tags that define parameters for how the applet looks and behaves. The View applet exposes a number of public methods such as open document, delete document, view next, and collapse all. For example, you could use JavaScript to return the IDs of selected documents, then pass them to the server or an agent to either move to a folder or delete.**

**The R5 ORB is a specialized subset of IBM's CORBA Component Broker technology, hard-wired to talk via the Internet Inter-ORB Protocol (IIOP) to the Domino back-end object model. A client-side ORB along with client-side objects can be automatically downloaded to a browser, network computer, or native Notes client when a connection to the Domino server is established. This enables the client to execute Domino's back-end services locally, minimizing network traffic and offloading some processing from the server. Where the UI applets serve up a fixed set of capabilities, CORBA tools give you complete control of Domino services over the Internet. Developers can build applications that preserve state management, leverage Domino strengths such as replication and security, and use the more efficient IIOP.**

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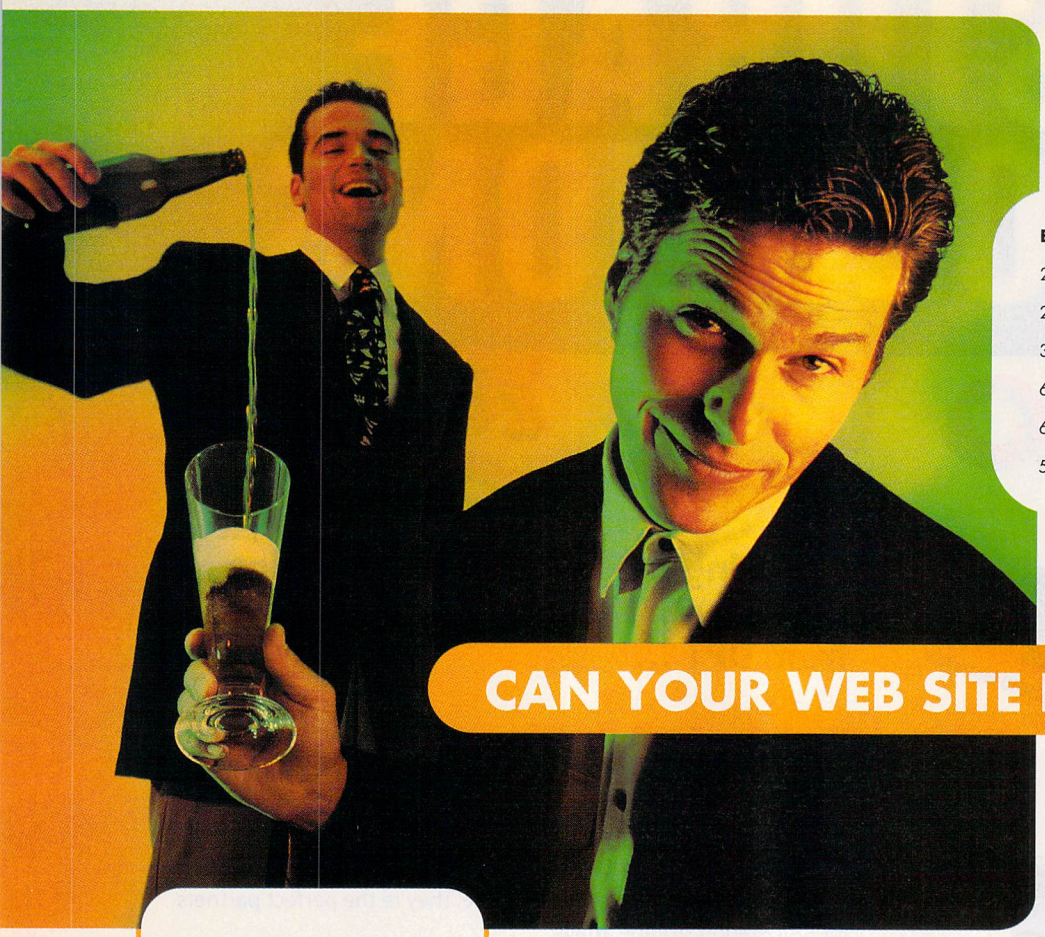
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24 database tables

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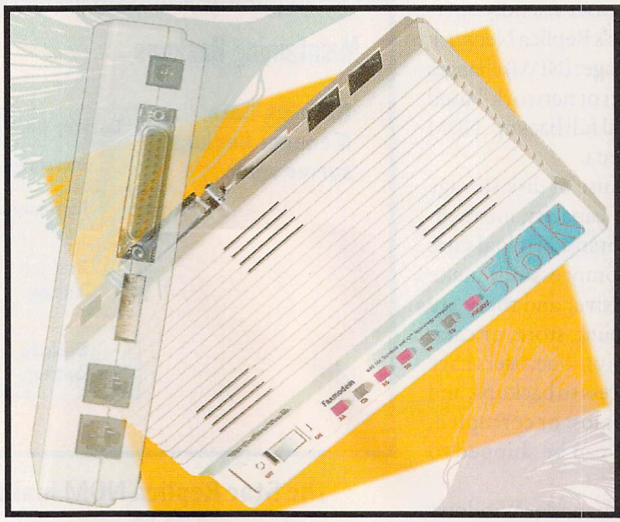
*3Com's Sportster 5686 connects at V.90 and offers backward compatibility to both X2 and K56flex. By Mark Brownstein*

# V.90 Modem Sets a Standard

When considering the newest 3Com/US Robotics 56K fax-modem, the Sportster 5686, you may have to ask yourself why you want it in the first place.

The Sportster 5686 can connect to V.90 (the official standard determined by the International Telecommunications Union) and X2 servers, receiving data as fast as the theoretical 53K limit in North America. (It can connect to K56flex servers only at standard—i.e., 33.6-Kbps or less—speeds.) However, with free upgrades promised for most X2 and K56flex modems, this unit is clearly not for those who already own easily upgraded 56K models. Instead, this modem is for those who chose to wait to purchase 56K when the standards battle is resolved.

Cosmetically, the 5686 is nearly identical to 3Com/USR's previous external Sportster modems. It has an on-off switch on the front, flanked by an array of status lights. Connections for power, DB25 serial cable, two RJ11 jacks for connecting to the phone line and passing the signal to a telephone, and a set of DIP switches take up the rear of the box.



**3Com/USR Sportster 5686 external modem $179**

3Com Corporation
Skokie, IL

800-3425877
847-982-5151

http://www.3com.com

Enter HotBYTEs No. 976.

**The new Sportster is slightly faster with a V.90 connection than with the also-supported X2.But upgraded modems fare just as well.**

I tested the Sportster 5686 in comparison with a standard X2 modem that had not been upgraded to V.90. Each test involved the same phone number, and was done at the same time of day, on a number of different days.

The 5686 was able to connect at speeds of 49,333 bps roughly nine times out of 10. The X2 modem didn't always fare as well, connecting at 49,333 bps only 20 percent of the time. Remaining connections were made between 31,000 and 45,000 bps. The difference could be a result of new line-probing routines built into the 5686 (they analyze and adjust modem frequency); they'll also be incorporated into X2 upgrades.

Connection to an X2-only provider using either modem was a more variable experience, with speeds ranging from 49,333 bps down to about 33,000 bps.

At press time, the upgrade for my modem was not available, but by the time you read this, the code for all models should be ready, 3Com/USR says.

The Sportster 5686 is a satisfactory, pretty basic modem that essentially works as advertised. It can connect to X2 and V.90 servers, send/receive faxes, and make lower-speed connections to modems and central site equipment that have not yet implemented either X2 or V.90 standards.

But other than the new V.90 support, nothing much else has changed with the latest Sportster. If you need a basic 56K modem (and your ISP supports either X2 or V.90), the Sportster remains a sensible but uninspired choice. B

| RATINGS | |
|---|---|
| TECHNOLOGY | ★ ★ ★ ★ |
| IMPLEMENTATION | ★ ★ ★ |
| PERFORMANCE | ★ ★ ★ ★ |

*Mark Brownstein is a freelance journalist based in Northridge, CA. He can be reached at* **mark@brownstein.com.**

## TECH FOCUS

### V.90: The Waiting Game

**X2 and K56flex were two incompatible methods developed to enable data transfers from an ISP to a modem at speeds approaching 56K. V.90 is a specification that defines a standard method for making these higher-speed connections. US Robotics, which developed the X2 specification, and Rockwell Semiconductor, which developed K56flex, met under the auspices of the International Telecommunications Union (ITU) last year to hammer out a specification both could agree on. The specification, which defines a negotiation method for V.90 servers to detect and connect to V.90 modems, is still not entirely settled but will probably be ratified this September.**

PHOTOGRAPH: STEVEN GREENBERG © 1998

*Incremental, disk-based backup and user-enabled file restoration make network backup easier.* ***By William Wong***

# Network Backup That Users Will Like

With its fast, user-friendly operation, Stac's Replica Network Data Manager (NDM) changes our notion of network-based backup. After an initial full backup, NDM saves only changed data.

Key to NDM is the use of disk storage instead of tape. High-capacity, inexpensive disk drives and Stac's original core competence (data compression) make disk storage inexpensive, and there are no tapes to track, mount, store, or catalog. Past data is always on-line, users have immediate, secure access to backups, and if a remote user's PC is lost or corrupted, all the archived data can be shipped to him or her on a CD.

The NDM server runs under Windows NT Server 4.0. Users' Win 95 or NT 4.0 PCs require about 50 MB for program and data files. NDM uses TCP/IP, so it can operate over the Internet, although most organizations would then want the security of a virtual private network (VPN).

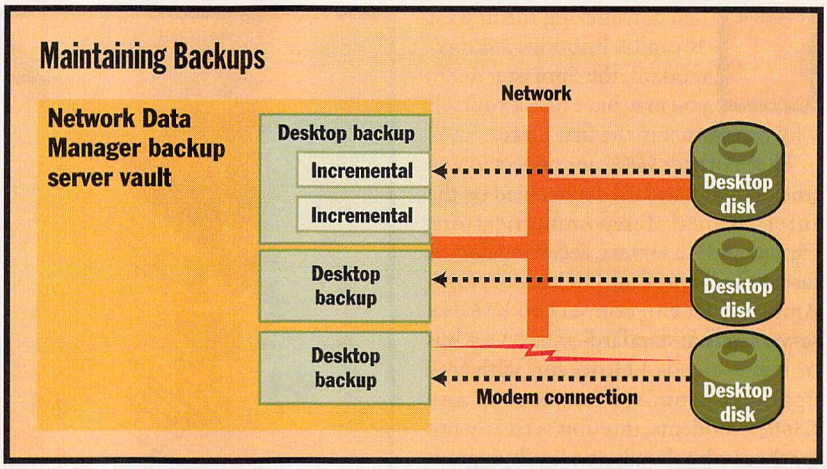
The installation program created our NDM server and vault, a Web page for client installation, and a Microsoft Management Console (MMC) snap-in for setup and administration. Future support is promised for tools such as Tivoli TME 10. Clients can also be installed via distribution tools (e.g., Microsoft's Server Management Service) or a separate install program. Time for initial backup varies, but you'd normally do it over a LAN. Subsequent backups typically transfer only a few hundred kilobytes, taking but seconds on a LAN and minutes via modem.

We tested NDM in beta. Using MMC, we tracked vault use, set user storage limits, calculated storage estimates, and pruned existing vault contents. Client management is limited, but we could set up schedules and filters for backups.

We found some problem areas. NDM restricts access by user and workstation: As administrator we couldn't access a user's NDM-archived data, which caused some silly and annoying workarounds. We also noticed a limitation of Stac's file-centric approach: NDM saved the Windows registry but didn't update registry entries when we restored applications.

Replica NDM doesn't replace regular, archival file-server backup for off-site storage. But it removes most of the administrative burden and makes real-time unassisted restores possible. We would not call NDM a zero-administration system, but it comes very close. B

*William Wong (**bwong@voicenet.com**) is a computer consultant and author.*




**The Stac Replica NDM maintains a workstation's backups on disk using fast incremental backups.**

## TECH FOCUS

### Squeezing Down the Data

**Incremental backup over a network is certainly nothing new, but Stac puts a neat twist on the technology. Time and space are compressed through three techniques that Stac collectively calls Net Pack. First is standard LZS compression processed by the client; second is transmission of file deltas (changed data, not entire files); and third is the elimination of the redundant file storage common to multiple users—a network needs to store only one copy of standard EXE and DLL files. This allows efficient backup even over a 28.8-Kbps dial-up line, making the system practical for telecommuters and mobile users. Unlike with tape-based systems, users can access their own backups and restore files without help.**

## PRODUCT INFORMATION

**Replica Network Data Manager**
Starts at $500 per user (Windows NT or Windows 95 required)
Stac
San Diego, CA
619-794-4300
fax: 619-794-4570
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| RATINGS | |
|---|---|
| TECHNOLOGY | ★ ★ ★ ★ |
| IMPLEMENTATION | ★ ★ ★ |
| PERFORMANCE | ★ ★ ★ ★ |

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

*Extensions to the Posix standard support real-time needs such as timing, scheduling, and messaging.* ***By Bob Friesenhahn***

# Real Time Goes Mainstream

Real time is all about providing a result in a bounded amount of time. It is about juggling multiple inputs from the outside world and supplying outputs back to it exactly when needed. An example of a real-time application is the antilock brakes on your car (they must be accurately pulsed tens of times per second). To satisfy the needs of real-time systems, APIs must be available to support accurate timing, fast communications and I/O, and precise, priority-driven scheduling.

Conventional wisdom held that without proprietary APIs and OSes, it was impossible to achieve the level of performance required to solve real-time problems. However, there are significant costs associated with coding solutions to a proprietary product.

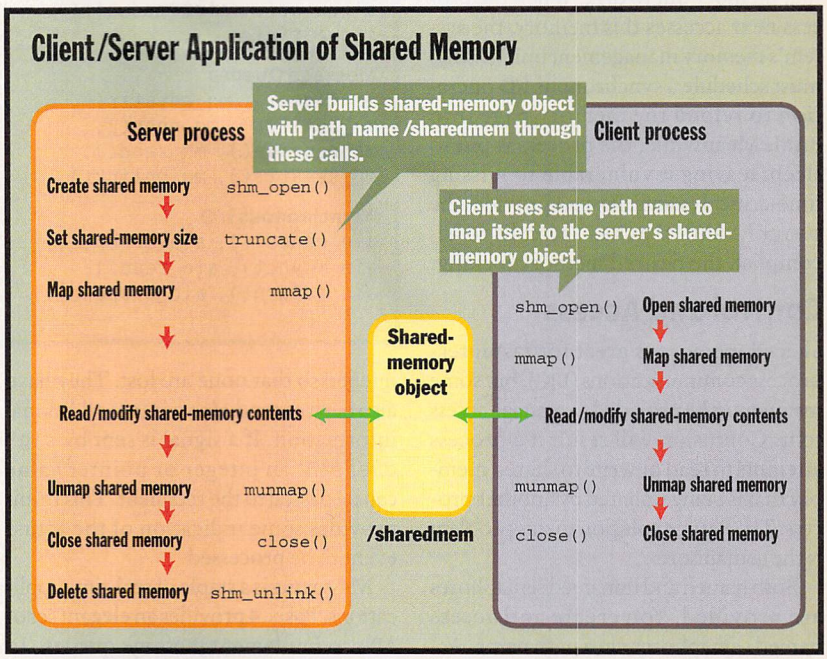
Recognizing this, OS vendors, researchers, and users participated in an IEEE working group known as Posix.4. The group's goal was to refine existing Posix APIs and develop new APIs to address the needs of the real-time environment. The result of this effort was the Posix 1003.1b-1993 standard, or Posix.4.

To address the need for efficient communications, the group added APIs that support memory mapping, message queues, semaphores, signals, and asynchronous I/O, or it extended existing calls. It also added timers, memory locking, and programmable scheduling capabilities to support the accurate timing and scheduling necessary for time-critical tasks. Many legacy OSes offered one or more of these features, but often as a clumsy, heavyweight, kernel-based implementation, rather than the simple and fast implementation necessary for real-time applications.

## Real-Time Additions

Posix specifies an OS environment where multiple processes operate independently, each with its own protected address space. While the protected address space ensures that processes do not affect a system's integrity or that of other processes, this environment is confining for real-time communications. This is because programs must perform time-consuming OS calls to communicate with each other and with the outside world. The fastest form of communication is through memory itself. Therefore, for processes to interoperate at the highest possible speed with each other or with devices, they must be able to share physical memory.

Posix.4 defines a sophisticated yet elegant function called `mmap()` that uses a file descriptor to establish shared-memory mapping. Here's how it works. First, the `shm_open()` call provides an easy means to obtain a file descriptor corresponding to a supplied path. If multiple processes call `shm_open()` with the same path argument, and each process supplies this returned file descriptor to `mmap()`, this effects a mapping to the same physical memory. That is, all the processes access the same block of memory, as shown in the figure "Client/Server Application of Shared Memory."




**Posix.4 lets programs easily set up shared memory for high-performance interprocess communications.**

`Mmap()` is extremely powerful. It maps memory among processes. Also, you can use it to map a disk file into memory. You can read or alter data in the file through fast memory operations, rather than through the traditional set of open/read/write/close calls. To ensure safe operation, `mmap()` provides control over which processes are allowed to read or write given shared-memory areas.

Traditional synchronous I/O (e.g.,

writing to a disk file) puts an application to sleep while the I/O operation is pending (an unbounded time). Clearly, this action is not suitable for a real-time application that must always be ready to handle an event.

To satisfy this requirement, Posix.4 provides asynchronous I/O (e.g., `aio_read()`), so that the application can continue executing and be notified (via a signal) when the operation completes. A list I/O (`lio_listio()`) function can execute many synchronous or asynchronous I/O operations via a single command.

When a real-time process executes on a demand-paged OS, it must ensure that any memory it uses stays locked in physical RAM. If it does not, the OS might page that memory out to disk. When the process next accesses this memory, the system's memory management unit (MMU) must schedule a synchronous I/O operation to reload the memory page into RAM. Meanwhile, the process is put to sleep, leaving it vulnerable to missing time-critical events. Posix.4 provides the `mlock()` and `mlockall()` calls to accomplish the desired memory locking.

## Control and Access

Shared memory is great for fast interprocess communications (IPC), but some means must be provided to manage access to it. Confusion will result if a process attempts to read or write to shared memory that is being updated by another process. The Posix.4 solution to this problem is the semaphore.

Both named and unnamed semaphores are provided. You create and access named semaphores via a path name. Access to named semaphores is through the `sem_open()` call. Unnamed semaphores are created directly in shared memory and managed by the user. Through the use of shared memory and unnamed semaphores, it is possible to build elaborate shared data structures with fine-grained locking.

Event notification is vital to real-time applications, because processes must react quickly to outside events—such as releasing the brake on a wheel just about to lock up. Posix.4 provides an extension to traditional Posix signals called real-time signals. Posix signals simply set a bit, so it is impossible to know how many signals were actually sent to a process, or why.

In contrast, real-time signals are queued so that none are lost. They have also been extended to contain additional information. If a signal is sent by `sigqueue()`, an integer or pointer value can be passed to the recipient. This result provides some indication of the actual event to be processed.

Messaging is a staple of real-time applications. Posix.4 provides an elegant set of APIs to implement message queues. To address real-time requirements, Posix.4 message queues support at least 32 levels of priority and can use real-time signals to notify a recipient of delivery.

Message queues are efficient: Tests show that they are two to four times faster than traditional communications mechanisms such as sockets. Message queues are accessed via `mq_open()`, which uses a path name to identify the message queue to access.

Real-time applications must ensure that operations occur on schedule. To meet these requirements, Posix.4 provides real-time clocks (`clock_gettime()`) with up to nanosecond resolution and real-time timers (`timer_create()`). Unlike traditional Unix timers, many real-time timers can coexist in one process.

Posix.4 timers use real-time signals to notify the process when an interval has expired. If all that is needed is a simple time delay, the `nanosleep()` call can delay the current thread of execution for a precise amount of time. In addition, Posix.4 provides a set of scheduling APIs that let a process define, query, and alter the scheduling policies and characteristics that apply to that process.

## Get Real

The astute reader will have noticed that the Posix.4 APIs are useful for normal applications as well as real-time ones. If these APIs are available in all target environments, there is no good reason not to use them. Besides the Posix 1003.1b-1993 standard and your system's documentation, the best text about the Posix.4 APIs is *Posix.4: Programming for the Real World* by Bill Gallmeister (O'Reilly & Associates, 1-56592-074-0). B

*Bob Friesenhahn is a consulting writer for BYTE who specializes in Unix and TCP/IP networking-related topics. You can reach him at* **bfriesen@simple.dallas.tx.us.**

## Posix.4 APIs

While the total number of new calls from the Posix 1003.1b-1993 standard fills the list shown here, they provide powerful capabilities to manage and respond to real-time events. Although `ftruncate()` is an existing call, its enhanced capabilities are so key to shared-memory programming that it is included. Calls are organized by category.

**Shared Memory**
```
ftruncate(), mmap(),
  mprotect(),
msync(), munmap(), shm_open(),
shm_unlink()
```

**Semaphores**
```
sem_close(), sem_destroy(),
sem_getvalue(), sem_init(),
sem_open(), sem_post(),
sem_trywait(), sem_unlink(),
sem_wait()
```

**Signals**
```
sigqueue(), sigtimedwait(),
sigwaitinfo()
```

**Message Queues**
```
mq_close(), mq_getattr(),
mq_notify(), mq_open(),
mq_receive(), mq_send(),
mq_setattr(), mq_unlink()
```

**Asynchronous I/O**
```
aio_cancel(), aio_error(),
aio_fsync(), aio_read(),
aio_return(), aio_suspend(),
aio_write(), fdatasync(),
  lio_listio()
```

**Clocks and Timers**
```
clock_getres(),
  clock_gettime(),
clock_settime(), nanosleep(),
timer_create(),
  timer_delete(),
timer_getoverrun(),
  timer_gettime(),
timer_settime()
```

**Scheduling**
```
sched_get_priority_max(),
sched_get_priority_min(),
sched_getparam(),
sched_getscheduler(),
sched_rr_get_interval(),
sched_setparam(),
sched_setscheduler(),
  sched_yield()
```

**Memory Locking**
```
mlock(), mlockall(),
  xmunlock(),
munlockall()
```



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*This proposed standard protects your Internet e-mail from eavesdroppers and tampering.* ***By William Stallings***

# S/MIME: E-Mail Gets Secure

Secure Multipurpose Internet Mail Extensions (S/MIME) is a security enhancement to the MIME Internet e-mail format standard, which is based on technology from RSA Data Security. Although both S/MIME and PGP are on an Internet-standards track, it appears likely that S/MIME will emerge as the industry standard for commercial and organizational use, while PGP will remain the choice for personal e-mail security.

## Extending the Standard

MIME is an extension to the old RFC 822 specification for Internet mail formats. RFC 822 defines a simple header with To, From, Subject, and Other fields, which are used to route an e-mail message via the Internet. Other fields provide basic information about the e-mail's content. RFC 822 assumes a simple ASCII text format for the content.

Later RFCs (1341, 1521, and 1522) introduce new header fields that make up the MIME standard. These fields define the body of a message, including its format and any encoding done to facilitate transfer.

MIME defines key content formats that standardize representations for multimedia e-mail, as shown in the table on page 42. Note that certain content types, such as Video and Application, consist of binary data. To protect such data from accidental modification by Internet software, it's mapped into printable ASCII characters using a scheme called radix-64 or base-64 encoding. Base-64 maps each input group of three octets of binary data into four ASCII characters.

S/MIME defines a set of additional content types, which are shown at the bottom of the table. In essence, these content types support four new functions, which are explained below.

*Enveloped data.* A message's contents are concealed within an "envelope" of encrypted data, which consists of encrypted content of any type, plus encrypted-content encryption keys for recipients.

*Signed data.* You form a digital signature by making a message digest of the content to be signed and then encrypting the digest with the signer's private key. The content plus signature are encoded using base-64. S/MIME e-mail software uses the signature to confirm that the message has not been tampered with.

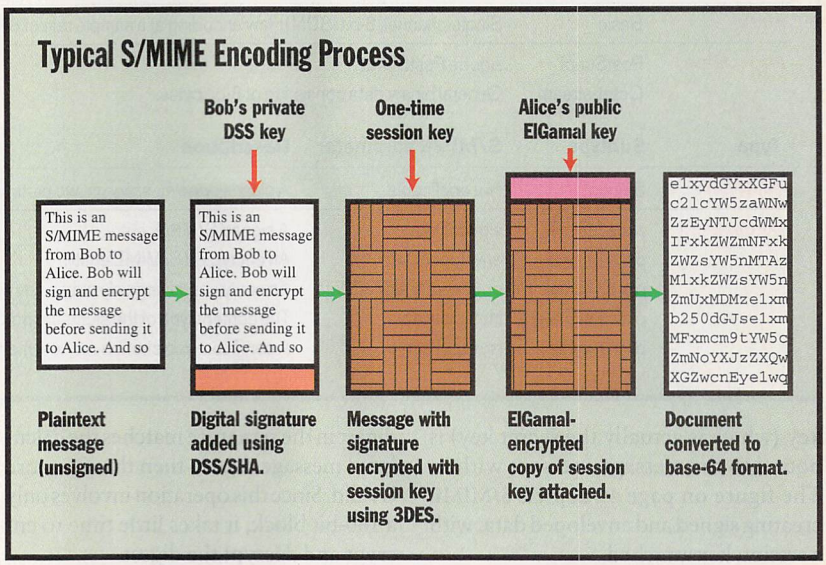
*Clear-signed data.* A digital signature of the content is formed. However, only the digital signature is encoded using base-64. Anyone can view the message, but only S/MIME-capable software can verify the signature.

*Signed and enveloped data.* Signed-only and encrypted-only entities can be nested so that encrypted data may be signed, and signed or clear-signed data may be encrypted.

## Securing the Message

For enveloped data, the default algorithms used for encrypting S/MIME messages are triple-DES (3DES) and a public-key scheme known as ElGamal. To begin, S/MIME generates a pseudo-random secret key. It is used to encrypt the message using 3DES or some other encryption scheme. The ElGamal algorithm encrypts the secret key using the recipient's public ElGamal key. On the receiving end, S/MIME uses the receiver's private ElGamal key to recover the secret key. Then it uses the secret key and 3DES to recover the message.

If the same key is used to encrypt every message, it's possible over time for an unscrupulous party to deduce the key. Therefore, S/MIME uses each secret key only once. That is, it generates a new pseudo-random key for each new message encryption. This so-called session




**S/MIME can wrap both a message and a digital signature into an envelope of encrypted data.**

## MIME Content Types

| Type | Subtype | Description |
|---|---|---|
| Text | Plain | Unformatted text; can be ASCII or ISO 8859. |
| | Enriched | Provides greater format flexibility. |
| Multipart | Mixed | The different parts are independent but are transmitted together. They should be presented to the receiver in the order in which they appear in the mail message. |
| | Parallel | Differs from Mixed only in that no order is defined for delivering the parts to the receiver. |
| | Alternative | The different parts are alternative versions of the same information. They are ordered in increasing faithfulness to the original, and the recipient's mail system should display the best version to the user. |
| | Digest | Similar to Mixed, but the default type/subtype of each part is Message/rfc822. |
| Message | rfc822 | The body is itself an encapsulated message that conforms to RFC 822. |
| | Partial | Used to allow fragmentation of large mail items in a way that's transparent to the recipient. |
| | External-body | Contains a pointer to an object that exists elsewhere. |
| Image | jpeg | The image is in JPEG format with JFIF encoding. |
| | gif | The image is in GIF format. |
| Video | mpeg | MPEG format. |
| Audio | Basic | Single-channel, 8-bit ISDN μ-law encoding at a sample rate of 8 kHz. |
| Application | PostScript | Adobe PostScript. |
| | Octet-stream | General binary data consisting of 8-bit bytes. |

| Type | Subtype | S/MIME parameter | Description |
|---|---|---|---|
| Multipart | Signed | Not applicable. | A clear-signed message in two parts: One is the message, and the other is the signature. |
| Application | pkcs7-mime | signedData | A signed S/MIME entry. |
| | pkcs7-mime | envelopedData | An encrypted S/MIME entity. |
| | pkcs7-mime | degenerate signedData | An entity containing only public-key certificates. |
| | pkcs7-signature | Not applicable. | The content type of the signature portion of a multipart/signed message. |
| | pkcs1-mime | Not applicable. | A certificate-registration-request message. |

key (which is actually the secret key) is bound to the message and sent with it. The figure on page 41 depicts S/MIME creating signed and enveloped data, with a session key attached.

For signed and clear-signed data, the default algorithms used for signing S/MIME messages are the Digital Signature Standard (DSS) and the Secure Hash Algorithm, revision 1 (SHA-1). The process works as follows. You take the message and map it into a fixed-length code of 160 bits, using SHA-1. The resulting 160-bit message digest is, for all practical purposes, unique for this message. It's virtually impossible for someone to alter this message or substitute another message and generate the same digest.

Then S/MIME encrypts the digest using DSS and the sender's private DSS key. The result is the digital signature, which is base-64-encoded and attached to the message. Anyone who gets this message can recompute the message digest and decrypt the signature using DSS and the sender's public DSS key. If the message digest in the signature matches the calculated message digest, then the signature is valid. Since this operation involves only a 160-bit block, it takes little time to encrypt and decrypt the digest.

## Public-Key Certificates

It's evident that S/MIME has an efficient interlocking set of functions and formats to provide an effective encryption and signature service. The basic tool that permits widespread use of S/MIME is the public-key certificate. The essential elements of a public-key certificate are the public key itself; a user ID, which includes the name and e-mail address of the key's owner; and one or more digital signatures for the public key and user ID.

The signer testifies that the user ID associated with a public key is valid. The digital signature is formed using the signer's private key. Anyone with the corresponding public key can verify that the signature is valid. If any change is made—to either the public key or the user ID—the signature no longer computes as valid.

S/MIME uses certificates that conform to the X.509v3 international standard. This widely used format is also employed in the IP Security (IPSec) and Secure Sockets Layer (SSL) technologies.

## Private Mail

As with any secure application that uses public-key certificates, S/MIME assumes there is some sort of public-key certificate infrastructure. In particular, S/MIME assumes that all participants rely on some type of trusted certificate-issuing authority. This infrastructure is still evolving.

S/MIME is relatively new, but it's already widely supported by vendors. Its growth is being fueled by the increasing reliance on e-mail for all sorts of business and legal documents. B

*William Stallings (Brewster, MA) has written many books on data communications. This article is based on his book* Cryptography and Network Security, Second Edition *(Prentice-Hall, 1998). You can contact him by sending e-mail to* **ws@shore.net**.

*An extension to the PowerPC architecture performs fast parallel vector operations.* ***By Tom Thompson***

# PowerPC Does Blazing Vectors

The nature of computing is changing. Today, desktop computers deal with more diverse types of information, such as digital video, 3-D graphics, telephony, and videoconferencing. Embedded processors don't have it much easier. The CPU found in a cellular phone must cope with several types of digital cellular protocols. The CPU found in a hand-held computer might format and send a fax, receive a wireless page, or perform speech recognition.

In short, today's processors—desktop or embedded—must accomplish a certain amount of signal processing and multimedia handling.

The computing brawn of PowerPC RISC processors has thus far let them handle modest digital-signal-processing tasks in software, such as implementing a V.32 modem or a speech-recognition engine. However, as the use of multimedia and communications work proliferates, these demanding tasks can tax the capabilities of even these processors.

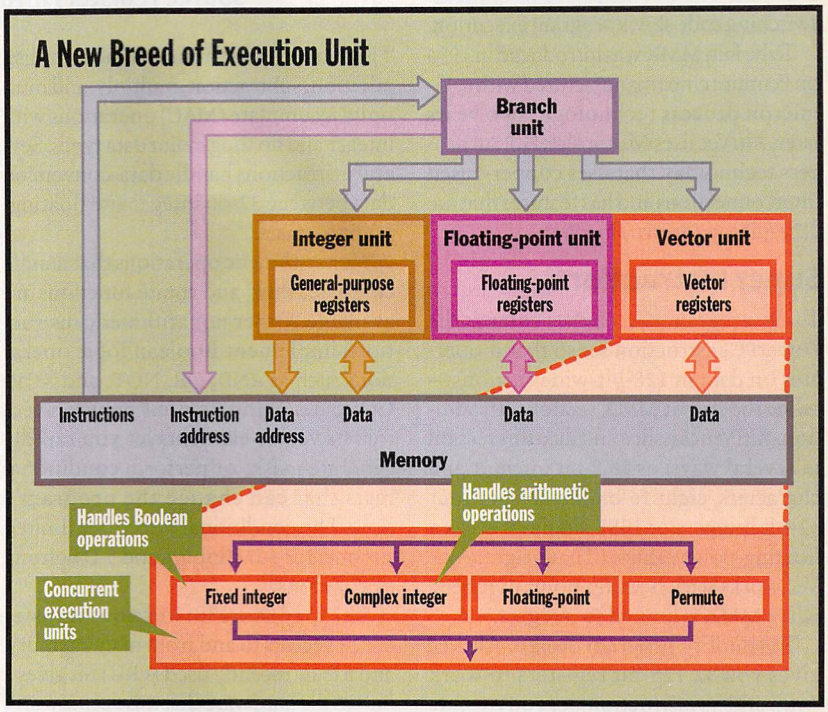
To address this growing category of work, Motorola announced the first extension to the PowerPC architecture since it was conceived in 1991. Called AltiVec, it provides a new set of instructions that endow a PowerPC processor with the ability to perform hardware-based, high-speed vector operations.

Vector operations are fundamental parts of signal- and image-processing algorithms. Therefore, AltiVec can significantly accelerate their execution. Because a vector is a one-dimensional array (or list) of data elements, and AltiVec instructions are designed to work on these elements in parallel, the technology implements the single instruction/multiple data (SIMD) operations often used in multimedia and communications programs. The first chip to use this technology will be a fourth-generation (G4) PowerPC processor that will begin sampling in the second half of this year.

## Work in Parallel

Because a comparison between AltiVec and Intel's MMX instructions is inevitable, I'll highlight the differences. AltiVec extends the PowerPC architecture to support vector operations by adding an autonomous 128-bit-wide vector execution unit to the microarchitecture, as shown in the figure "A New Breed of Execution Unit."

The vector unit operates in parallel with the processor's integer and floating-point units, which lets you freely intermix PowerPC integer, floating-point, and vector instructions. To keep data moving through the vector unit as fast as possible, 128-bit-wide data paths link the vector unit to the cache, the register file, and the load/store units. Within the vector unit, four parallel function units handle specific types of vector operations, such as vector integer math and vector floating-point math.




**A new execution unit implements vector calculation on the PowerPC.**

To further improve its bandwidth, the vector unit's architecture is simple. The only interrupt generated during execution signals the completion of load/store operations. The vector unit shares few resources and communications paths with the other execution units, and doesn't require synchronization with them. Nor does it implement complex functions: Many instructions execute in one cycle, while complex ones execute in three or four cycles.

This streamlined architecture does

exact a penalty: The vector unit has no hardware support for unaligned data accesses. However, a specialized vector instruction (the permute instruction, described below) can align data in main memory before the vector unit works with it. The vector unit should accelerate a PowerPC processor such that it can handle the concurrent real-time processing of one or more data streams.

Intel's MMX implementation aliases its eight 64-bit MMX registers over the Pentium family's eight 80-bit floating-point registers. This scheme conserves transistors in the design, but the trade-off is that you can't readily mix MMX and floating-point instructions in a program. If you do use the two, you must add special code that preserves the state of the two disparate register sets. The overhead of this context-switching code slows program execution.

To be fair, MMX was introduced in 1996 on Pentium chips manufactured with 0.35-micron process technology. Two years later, AltiVec uses Motorola's HiP 5.0 process technology that uses copper-based interconnections and has features that are 0.20 micron (drawn) in size.

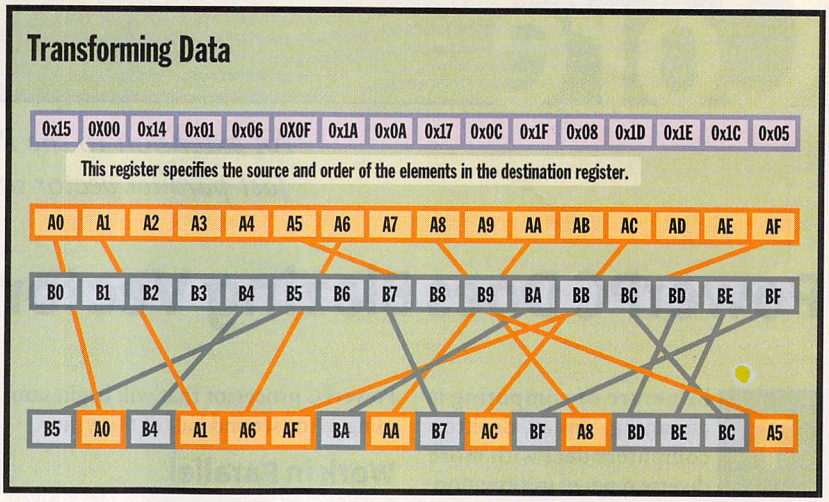
## Super Instructions

To the programmer, AltiVec extends the PowerPC instruction set so that it operates on data in 128-bit-wide sections—twice the size of MMX sections. In addition, AltiVec can slice and dice this section in several ways: as 16 8-bit integers and characters, eight 16-bit integers, or four 32-bit integers or IEEE single-precision floating-point values. (That's right: AltiVec works with floating-point numbers, while MMX is limited to integers.)

To simplify program design, AltiVec gives you 32 128-bit registers to work with, and its instructions let you execute vector computations on the register's contents in various ways. Additional instructions manage operations on 8-, 16-, and 32-bit Boolean data, while others perform sophisticated bit manipulation.

AltiVec augments the PowerPC instruction set with 162 new instructions, versus 57 instructions for MMX. Each instruction can specify up to three source vector registers, with the results placed in a single destination vector register. These instructions fall into two categories.

*Intraelement operations* take elements from the source registers, perform parallel computations on the data, and store the results in the destination register.




**The permute operation intermixes bytes from two source registers into a destination register.**

There are instructions that accomplish addition, subtraction, multiply, and multiply/accumulate (MAC) operations with integer and floating-point data types. Several instructions handle data-conversion data between 32-bit integer and floating-point formats.

Nonarithmetic operations that handle compare, shift, and rotate functions are available. Other nonarithmetic instructions implement Boolean logic operations such as AND, OR, NOT, and XOR. Comparison instructions between vectors or vector elements let you rapidly generate masks or perform conditional tests that can change the program's flow. The conditional tests offer limited support for 3-D clipping and 3-D lighting calculations.

The load/store instructions transfer entire vectors to and from main memory, and a least recently used (LRU) bit gives a hint to the hardware that this vector won't be reused again and can be purged from the cache. This is useful in situations such as streaming video, where the data is constantly changing. A data-stream touch instruction lets you buffer chunks of data in the cache to boost performance.

*Interelement operations* handle complex data-manipulation operations on vectors. For example, a vector sum across instruction lets you pick elements within a vector and sum them into a separate accumulation register. A vector multiply sum accumulates the sum of the product of elements inside two source vectors.

You can use these two vector instructions to write functions that generate dot products, a matrix operation that is the staple of imaging, engineering, and scientific computations. Pack and unpack instructions expand or condense data. These instructions also work on a pixel data type, which efficiently converts 16-bit video pixels (a 15-bit pixel with a 1-bit alpha channel) into 32-bit pixels (a 24-bit pixel plus an 8-bit alpha channel).

The most unique and powerful of these instructions is the permute instruction. As the figure "Transforming Data" shows, this instruction can take any 16 8-bit elements from two sources and place the bytes in any order in a destination register. This operation can, within a single cycle, let a network application extract an IP packet's header. Or, it could significantly boost the encoding or decoding of MPEG video data.

## Future Vectors

AltiVec is an innovative vector-processing technology that promises to accelerate many imaging, engineering, and scientific tasks. One problem is that AltiVec is, for now, a Motorola-exclusive technology. This isn't a problem in the embedded-product arena, where OEMs buy processors in huge lots from one vendor. However, it could create trouble on the desktop, where some systems use IBM PowerPC chips. Perhaps AltiVec will in time prove itself and bring convergence between the two companies. B

*Tom Thompson* (**tom_thompson@byte.com**) *is a BYTE senior technical editor. He has a BSEE degree from the University of Memphis.*



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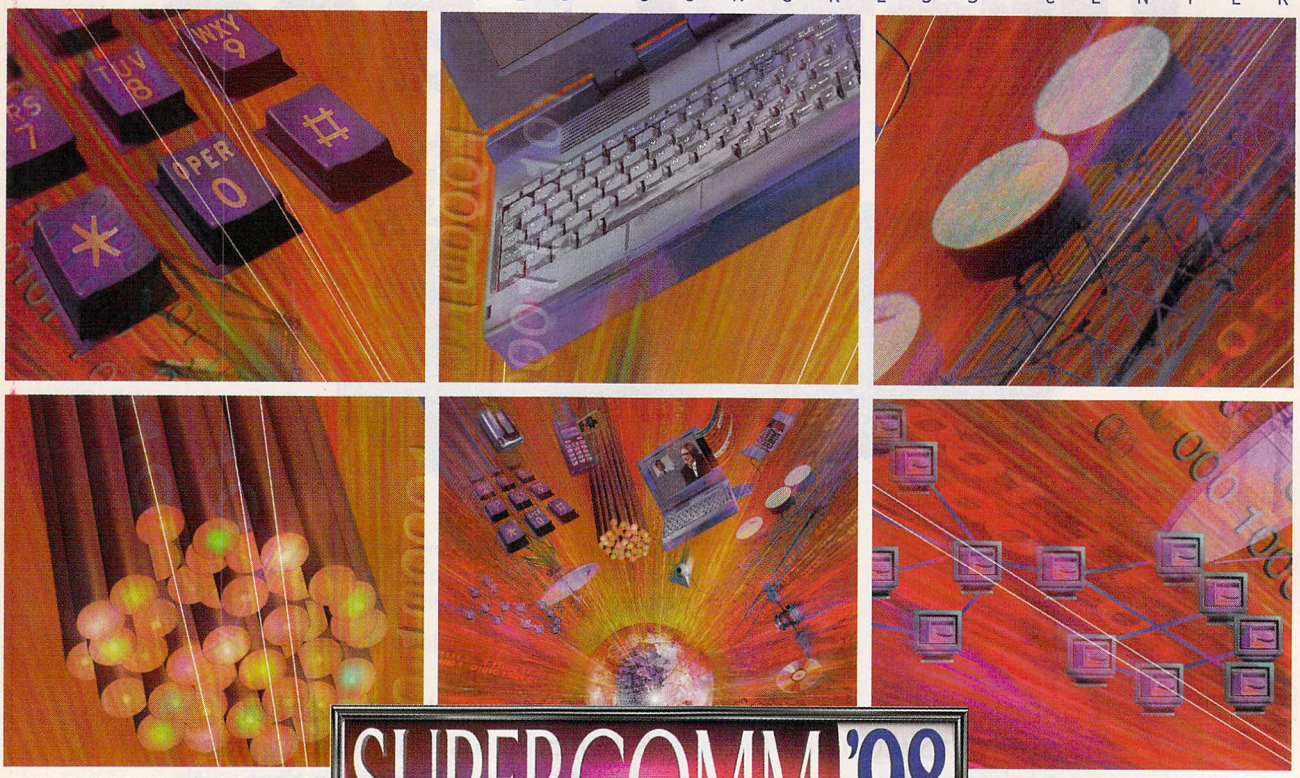
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*This international standard promises script compatibility across major Web browsers.* ***By Rick Dobson***

# ECMAScript: The Holy Standard?

Amid the bravado of browser wars and the sweet dreams of Dynamic HTML (DHTML) and Extensible Markup Language (XML) visionaries, the release of ECMAScript in 1997 received little attention. But Web developers should take note, because it promises a compatible development language across major browsers.

ECMA is a European industry association. Its goals include the development of a standardized, cross-platform, vendor-neutral scripting language. ECMAScript-262 is its working product (*http://www.ecma.ch/stand/ecma-262.htm*).

## Netscape and Microsoft

ECMAScript has its roots in Netscape's JavaScript and a Microsoft look-alike known as JScript. JavaScript's popularity among Web developers and the availability of comparable versions from both Netscape and Microsoft make it a good candidate for a cross-browser Web-scripting language. These two competitors also endorse ECMAScript for server-side development.

Microsoft supports ECMAScript through version 3.0+ of JScript. Its language documentation clearly delineates ECMA features versus extended, proprietary elements. JavaScript is mostly compatible with ECMAScript, because the standard derives from it. Nevertheless, a few missing links—such as support for Unicode—make the Netscape version not completely compatible as I write this. Netscape plans to upgrade JavaScript to ECMAScript conformance with its next major release.

## ECMAScript Constructs

ECMAScript code consists of individual statements, blocks of statements, and comments. Many JavaScript and JScript samples on the Web terminate each line with a semicolon. ECMAScript does not strictly require this in most situations, but the semicolon still has a definite purpose. For example, it's handy when you want to separate two or more statements on a single physical line. It's also useful for delimiting the arguments within certain statements (e.g., a `for` statement).

ECMAScript has six data types: numbers, strings, Booleans, undefined, nulls, and objects. Numbers follow the IEEE-754 standard for numerical representation that encompasses integers and floating-point numbers, positive and negative infinity, and positive and negative zero. Integers can express values in decimal, octal, and hexadecimal formats. ECMAScript delimits strings with single and double quotes. When double quotes are part of a string, use single quotes to delimit it.

Booleans can assume values of true or false. ECMAScript represents false with a value of 0 and true with any other value.

`Undefined` is a special data type that represents the value for a variable after its creation but before it receives a value from the program. `Null` represents no valid data. You can explicitly define a value of `null` to a variable, or it can result from an expression containing one or more other null values.

Developers not familiar with Java and C++ are likely to encounter some nonintuitive ECMAScript operators. For

## Code Gallery

### Add Min Sample

```
<html><script language=javascript>
function array_min( ){
  var i, min = this[0]
  for (i = 1; i < this.length; i++){
    if (min > this[i])
      min = this[i] }
  return min}
Array.prototype.min = array_min
var x = new Array(-3, -1, 1, 3, 5, 7)
var y = x.min( )
alert(y)
</script></html>
```

### Year 2K Bug Fix

```
<html><script language=javascript >
var y1999 = new Date("1 January 1999")
var y2000 = new Date("1 January 2000")
alert(y1999.getYear())
// In all versions of IE and Navigator, this returns "99".
alert(y2000.getYear())
// JScript 1.0 (shipped with IE3) returns "100", while
// Navigator and JScript 3 (IE4) this returns "2000".
alert(y1999.getFullYear())
// JScript 3 (IE4) returns 1999; NA in other browsers
</script></html>
```

example, the assignment and equal operators are separate. ECMAScript designates assignment with an equal sign. The sole, current equality operator (==) returns a true when two expressions have corresponding representations. This operator matches two expressions even if they are different data types, such as "1" and 1.

There are three distinct types of objects in ECMAScript. You instantiate any of them with the `new` operator. The first type contains nine intrinsic objects that form an integral part of the language. Some of these intrinsic objects, such as `Array`, let you manipulate object instances and properties. Other intrinsic objects, such as `Number` and `String`, facilitate the creation of data-type instances.

The second object type includes custom ones created by an application. You use constructor functions to define these new objects. You can also use an object's prototype property to add new features to an existing object. The "Add Min Sample" in the Code Gallery demonstrates how to add a new minimum method to an intrinsic `Array` object via its prototype property. New instances of the `Array` object inherit the new minimum method.

The third object type derives from the ECMAScript host environment. If you use it for Web work, this is the browser itself. The `alert` method in the next-to-last line of "Add Min" is actually a method of the window object. You can write to the browser window with either the `write` or `writeln` methods for the browser's document object.

## Code Gallery

### Time and Day Sample

```
<html><script language=javascript >
var d = new Date()
var h = d.getHours()
dNumber = d.getDay()
document.write("<BR> According to your clock, ")
if (h<12)
   document.write("it is " + h + ":" + d.getMinutes() + "  in the
morning, and ")
else
   if (h<17)
      document.write("it is " + (h-12) + ":" + d.getMinutes() +
" in the afternoon, and ")
   else
      document.write("it is "" + (h-12) + ":" + d.getMinutes() +
" in the evening, and ")
switch (dNumber){
   case 0:
      document.write("the day of the week is Sunday.")
       break
   case 1:
      document.write("the day of the week is Monday.")
       break
   case 2:
      document.write("the day of the week is Tuesday.")
       break
   case 3:
      document.write("the day of the week is Wednesday.")
       break
   case 4:
      document.write("the day of the week is Thursday.")
       break
   case 5:
      document.write("the day of the week is Friday.")
       break
   case 6:
      document.write("the day of the week is Saturday.")
       break}
</script></html>
```

## Working with Dates

The `Date` object is an intrinsic ECMAScript object that generates date and time values. Through its methods, your applications can create and retrieve dates and times. A selected set of JavaScript date methods permit the year 2K bug (i.e., years are represented internally by two digits, so that the year 1900 and the year 2000 are identical).

ECMAScript introduces a new method to resolve the potential year 2K coding problem. The old `getYear` function returns different values depending on the browser type and version, but it always passes back a two-digit number for the year 1999 (see the "Year 2K Bug Fix" in the Code Gallery).

The new `getFullYear` method always returns a four-digit number for the year. This successfully resolves the year 2K bug for programmers concerned about it.

The "Time and Day Sample" in the Code Gallery above illustrates how to extract the hour, minute, time of day, and day of the week from a date created with the intrinsic `Date` object. The code illustrates some of the richness of the `Date` object with its use of the `getHours`, `getMinutes`, and `getDay` methods. These methods drastically simplify the task of extracting values from the `Date` object. To conserve space and simplify the sample code, there is no test and insertion of a leading zero when the minutes are less than or equal to nine.

## Why ECMAScript?

Is ECMAScript just another scripting environment, or does it offer a significant opportunity to simplify and speed Web development? My answer is yes to both questions. ECMAScript has the benefit of being an open standard. Hundreds of thousands of existing Web pages illustrate successful JavaScript coding practice. This can be a real advantage when it comes time to improve your skill by adapting prior working pages.

ECMAScript is worth learning and using, because it stands a chance of becoming a cross-browser development tool that's based on the work of an international standards organization. Simply put, ECMAScript is for developers who write Web applications that must run on all browsers. B

*Rick Dobson, Ph.D. (**RickD@cabinc.win.net**), is president of CAB, Inc., a database and Internet consultancy.*

*An application server provides a reliable middleware solution for deploying transaction applications on the Internet.* ***By John Fomook***

# Moving Mission-Critical Apps to the Web

The growth of the Internet has shown the advantages of networked systems based on open standards. The World Wide Web has created a platform-independent software model, where information and applications running on one machine can be accessed by a large number of people using a variety of devices. The Web's unified client interface offers to drastically cut the cost of accessing systems. Another benefit is that it reduces the time and effort required to connect users to information.

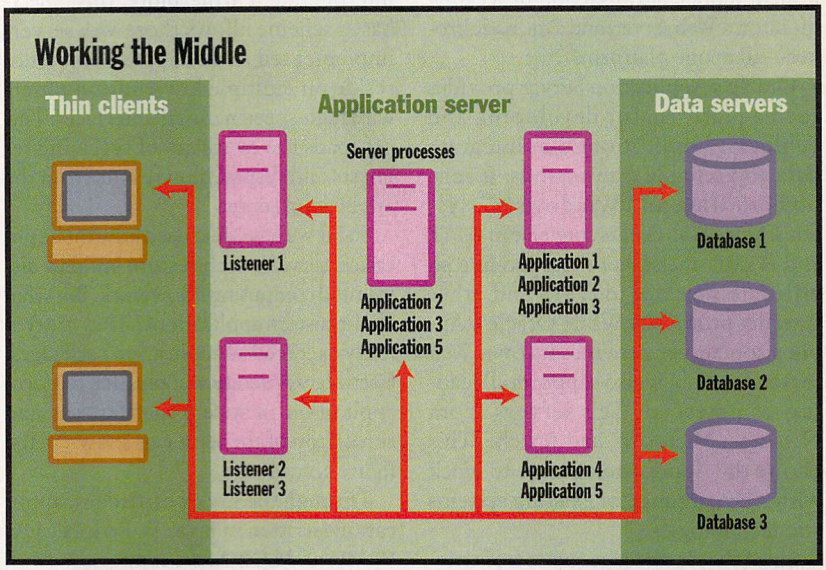
However, most existing transaction applications and systems still use mainframes and conventional client/server environments. That's because they have evolved over the years to provide the high levels of security, reliability, and scalability that these mission-critical applications require. Many businesses have therefore been cautious about migrating to the Web's thin-client architecture until its technologies can offer comparable degrees of features and functions.

A key development that addresses this problem is the emerging product category known as application servers. Broadly defined as a platform for shared application logic, an application server acts as an intermediary between a thin Web client and a company's custom applications and databases. This article looks at the emergence of this new category, and some of the key issues that Oracle Corporation had to solve in building version 4.0 of its Oracle Application Server.

## Application Server Origins

Early on, intranet users were treated to static content. Pages of text and graphics—perhaps forms displaying benefits information—could be viewed by a large number of users through a standard browser. Soon after, organizations placed simple dynamic content on-line, where users could obtain and view the current shipping information from the company's database. For both purposes, a basic Web server that serviced HTTP requests and returned HTML information was sufficient.

Supporting more complex "live" application models and mission-critical transaction applications requires solid integration with a database, as well as scalability, reliability, and integrated security—all for an army of users. Organizations have employed different types of middleware to piece together the disparate systems that hold the client/server application logic and the databases. Transaction processing (TP) monitors are used to manage database resources, performing resource allocation, transaction coordination, and database connection pooling. Client/server systems often use their own proprietary middleware. Custom applications are written that provide their own plumbing, network services, and interfaces to external systems, possibly through an object request broker (ORB). It's not uncommon to find an enterprise application that uses a proprietary network stack to talk to a special server, that talks to an ORB, that talks to a TP monitor, that talks to several database access products, which then update the database. In such situations, basic Web servers do not deliver. An application server provides the needed middleware that brings together browsers, Web servers, databases, transactions, and live network applications.




**An application server acts as an intermediary between front-end thin clients and back-end databases.**

## What Is an Application Server?

To recap, an application server is a platform for shared application logic. By moving this logic to a mid-tier environment that hosts and executes enterprise applications, organizations can signifi-

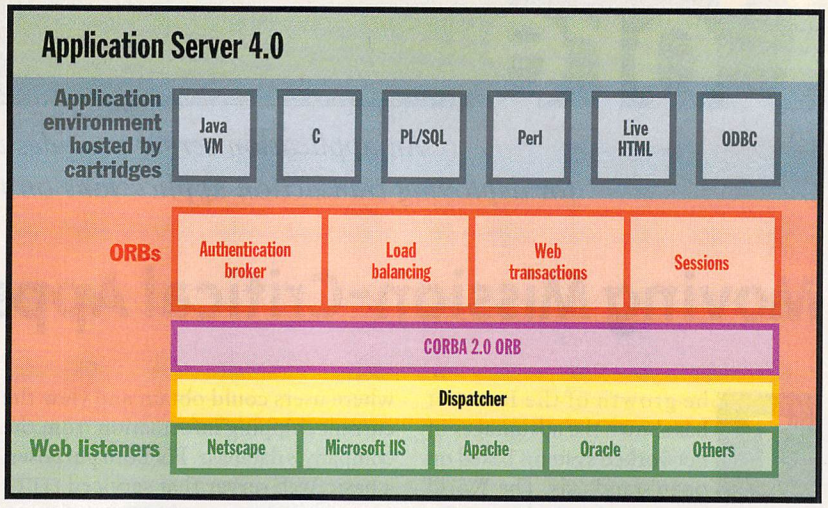
cantly reduce the cost and the difficulty of providing access to corporate databases and transaction services. Users tap into these services through just a browser, while the application server manages vital services such as integrated security, reliability, and scalability. Generally speaking, an application server offers Web access to enterprise applications, while maintaining quality of service, as shown in the figure "Working the Middle" on the previous page.

To deliver complete application services to network clients, an application server must encompass some of the capabilities of technologies that have gone before it. With Java, CORBA, and COM emerging as de facto component models, we need built-in support for them. To fully integrate multiple applications, application-level messaging would be an advantage. You need OS services, a component model, a transaction processing monitor, a Web server, and a message broker—all in one platform.

Oracle's Application Server provides such a platform for developing and deploying applications that integrate data and reliable transactions. It runs on both Unix and Windows NT systems. Since Web clients converse in HTTP and HTML, the server must provide an efficient interface to HTTP and other Internet protocols. While Oracle's Application Server provides its own Web server daemon, it also supports all leading commercial Web servers from Netscape, Microsoft, and Apache. This allows the Application Server to work with a broad range of existing systems and technologies.

Since they look for requests from networked users, these Web servers are dubbed Web *listeners*. Multiple listeners can be running throughout the network, forwarding requests to the application server. Requests from the listeners pass through a dispatcher, which is a flexible interface mechanism that routes the requests to the appropriate application logic.

The key component that implements this low-level plumbing is a CORBA-compliant ORB that provides access to object-based services. These services handle authentication and load balancing and manage database sessions or transactions. Because the application server's architecture is based on the CORBA distributed object model, server modules can exist on separate, networked machines and interoperate. Furthermore, this object-based scheme allows those Web servers implemented as distributed objects to reside on multiple low-end computers with high-speed network interfaces. This off-loads the overhead of receiving requests and dispatching results from the application server.




**The application server architecture uses CORBA objects to provide OS and listener independence.**

So far we have discussed how the application server's architecture builds a distributed computing framework. But what about custom applications? They are typically executed as application cartridges. Cartridges are code modules that perform application- or system-specific tasks, and run on top of the server, as shown in the figure above.

Through the use of cartridges, applications written in Java , C, Perl, PL/SQL, VRML, and COBOL are supported. As an example, existing Perl applications can be quickly and easily redeployed as enterprise applications via the Oracle Perl cartridge. The cartridge has a Perl 5.003 interpreter built in and provides a run-time environment that can use Perl v5 database interface (DBI) extensions. The cartridge automatically loads the proper Perl scripts when requested via a URL. The Perl scripts are maintained as persistent applications, so they don't incur the usual overhead of starting and stopping them, as with CGI calls. This not only offers a tremendous improvement in response time, but a session's state can also be preserved across calls. Among others, there's a Java cartridge that provides a server-side virtual machine, and an ODBC cartridge that offers access to databases that support ODBC.

Scalability and reliability are fundamental requirements for any application server that provides access for a very large number of users. The application server's distributed object architecture allows hundreds or thousands of application cartridge instances to execute on one or more servers. In addition, the application server includes services for fault tolerance, automatic failover, load balancing, and process isolation.

## Enterprise-Capable

An application server is the solution for deploying real business apps on the Web. Web environments with application logic deployed on mid-tier servers enable a more flexible and robust computing model at a far lower cost. By supporting any sort of Web server on the front end, and providing access to any back-end database through cartridges, an application server can tie together all of an enterprise's heterogeneous systems.

It is now possible to deliver network applications with the same quality of service associated with mainframe and client/server computing. By building systems around an application server, companies can leverage a comprehensive technology platform while at the same time reducing cost and complexity through thin-client computing. B

*John Fomook is the director of product marketing for Oracle's Application Server Division. He can be reached at* **jfomook@us.oracle.com.**



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# Year 2000 SURVIVAL Guide

*You no longer have time to fix problem systems before Year 2000. But your enterprise might still survive—if you start work now.*

*Edmund X. DeJesus*

The ship is your company. The iceberg is January 1, 2000—Black Saturday. The good news is that you can see it coming. The bad news is that you're heading right for it. The worse news is that you can't turn in time. Now what?

As the entire world now knows, there's a problem with computer hardware, software, and data. For many reasons, programmers have routinely used only two digits to represent the year in dates. Thus, 25 meant 1925. This works fine until the year 1999. After that, two-digit dates cause confusion because, if 25 means 1925, then 00 means 1900.

This is called the Year 2000 problem—or Y2K for short, or sometimes the Millennium Bug (although it's not a bug at all, and a lot of people are going to miss the party of a lifetime by insisting that the millennium begins with the year 2001). Y2K is a crisis without precedent in human history. We know exactly when it's going to occur. We also know that its effects will be global. We even know what's causing it and what to do about it. That's right: We can, if we all choose, solve it before it happens, although we probably won't.

There are those who say Y2K is just a lot of hype. Their argument seems to be based on the fact that consultants and software vendors are making money from Y2K; ergo, it's a hoax. Hey, drug companies make money from heart medication: Maybe heart disease is a hoax, too. Now is not the time to complain that the lifeboat builders are making money. You'll have plenty of time to hoot and laugh on January 2, 2000, assuming you still have a company left. Until then, your best bet is to take what lifeboats are available and start rowing.

In this article I'll look at the scope of the Y2K problem and some of the techniques for solving it. Most important, in case you can't solve your Y2K problems in time, I'll outline a Plan B: What to do if (or when) you get tagged by Y2K.

## The Scope of the Problem

If the sole result of Y2K was the utter failure of a computer system, that would be regrettable—not irreparable. Unfortunately,

### Time Line: Chronicle of the Slow Collision

**1993**
Boeing notes errors in seven-year lead time for orders.

**1998**
**February 8:** 100 weeks to Y2K; many failures already reported.

**July 6:** "9876" might be a "signal" (i.e., a fake date with special meaning).

**1999**
99 is used as an "infinite" date.

**January:** One-year projections fail; insurance for Y2K-related losses and liability becomes popular.

## How Different Y2K Solutions Rate

**Data-year expansion:** Expand the year field to four digits in data.

**Software-year expansion:** Expand the handling of the year field to four digits in software.

**Compliant commercial package:** Upgrade or replace existing software with a compliant commercial package.

**Code years in binary:** Use, for example, the two bytes of a year field to code 65,536 years rather than two ASCII numbers.

**Duplicate databases:** Construct two- and four-digit-year versions of each database for use with compliant and noncompliant applications.

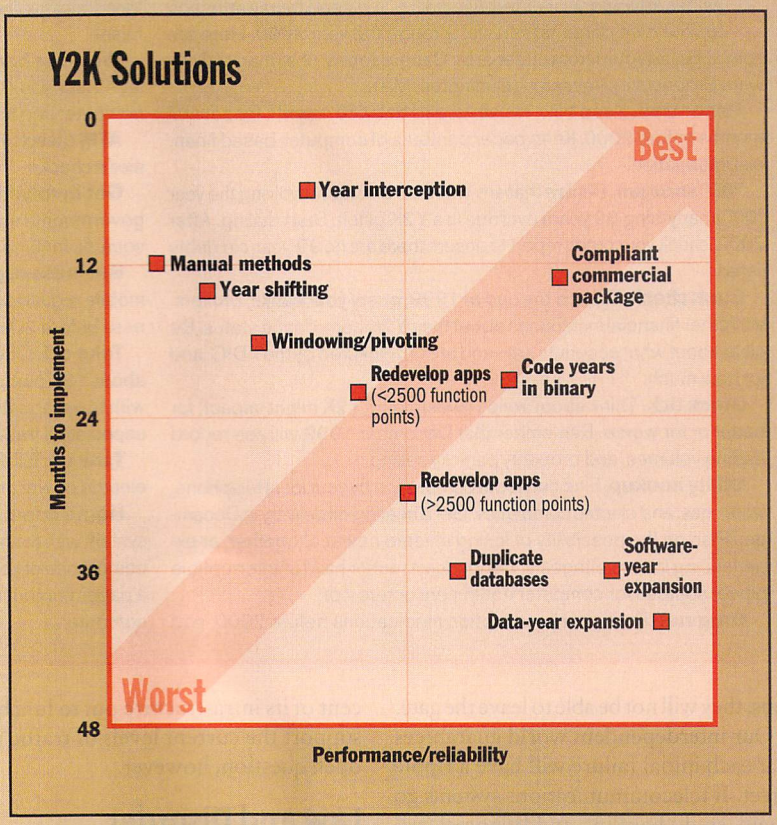
**Redevelop applications:** Rewrite applications from scratch, incorporating Year-2000 and wish-list features.

**Year interception:** Intercept each year calculation and comparison and replace with the correct results.

**Windowing/pivoting:** Choose a pivot year (say, 1930) and then interpret years ending in 30 to 99 as 1930 to 1999, and years ending in 00 to 29 as 2000 to 2029.

**Year shifting:** Shift all years down by, say, 28, so that 2000 appears as 1972.

**Manual methods:** Paper, pencil, and calculator.




as with icebergs, what does the most damage is the part you can't see: Computer systems might run fine but produce incorrect information that's very difficult to detect. Centenarians have already begun to receive invitations to attend kindergarten because school-department computers can't tell a birthdate in the 1890s from one in the 1990s. Multiyear projections have already begun to yield spurious results in insurance, demographics, bond maturities, and supply planning—because subtracting a date in the nineties from a date ending in 00 gives a negative number. For example, according to Boeing's Bob Jorgensen, Boeing knew in the early 1980s that the year 2000 would cause problems. As with other aerospace companies, they must plan certain metal orders up to seven years in advance. Thus, they began noticing incorrect results as early as 1993.

The problem is larger than most people think. First of all, it's not just mainframe software that's affected. Hardware also suffers from Y2K consequences; after all, a chip is just solidified software. Embedded systems show up for monitoring and control in places as diverse as power stations, water plants, phone switches, and burglar alarms. One commonly cited problem is associated with gadgets that monitor periodic maintenance. When the clock strikes twelve on New Year's Eve, 2000, these devices might think it's been 99 years since their last maintenance, realize that's too long for safe operation, and shut down. Not good, especially if it's the device that monitors your IV.

We can alleviate two mythical fears here. Elevators will not fall: If they have such monitoring chips, and if the chips act up, the elevators will return sedately to the first floor, open their doors, and not budge until someone resets the chip. Boeing's Jorgensen explains that airplanes will not crash. If anything hap-

**(based on time-line information from Dr. John R. Stockton, Surrey, U.K.)**

**January 1:** Last year of the 1900s begins; "99" might be a "signal."

**January 1:** Transition to the Euro begins within contiguous Europe.

**March:** Securities Industry Association simulates December 29, 1999, trading.

**April 1:** New York state's fiscal year (FY) 2000 starts.

**April 1:** The start of the Canadian and Japanese FYs.

**April 6:** The start of the U.K. FY 1999–2000.

**April 20:** 255 days left to year 2000.

**June:** More kindergarten notices begin to go out to centenarians.

## Y2K and You

Besides keeping your enterprise going, you need to pay attention to your own personal survival through the year 2000. Here are some tips, adapted from material by Capers Jones, chairman of Software Productivity Research (Burlington, MA).

**Paper trail.** Keep bills, receipts, and balance reports for several months before 2000. Keep paper printouts of computer-based financial information.

**"00" shotgun.** Realize that any weird bill or notice involving the year "00" or anything 99 years overdue is a Y2K glitch. Start dialing. After 2000, check your credit report to ensure there are no 99-year-old debts listed.

**Bank check.** Toward the end of 1999, query your banks, brokers, and other financial institutions about their Y2K-compliance status. Be clear about what accounts are—and are not—insured by the FDIC, and for how much.

**Stock tick.** Think about which investments Y2K might impact, for better or for worse. Remember that December 1999 will see record trading volumes, and probably panicky selling.

**Utility hookup.** Find out about compliance by your local telephone, water, gas, and electric companies. Get a heating-oil delivery in December. Plan on the possibility of losing electric power altogether, or experiencing lower voltages or frequencies; either have uninterruptible power sources for computer equipment or turn it off.

**Drug run.** Refill your prescription medications before 2000, and forgo pharmacy-compliance issues.

**Check stubs.** Examine paychecks carefully during 1999 and 2000 for correct tax and social-security withholding amounts and time-based raises.

**Working hard.** Make sure automated security systems at work won't lock you out and elevators won't keep you grounded. Find out if computer and network security passwords will time-out in 2000.

**ATM attack.** Keep some money available in the form of cash or traveler's checks.

**Get involved.** Raise the question of Y2K compliance with local governments and school systems. Inquire about plans, costs, and sources for funds.

**Business of government.** Renew your driver's license and automobile registration and transact any other government-related business before 2000.

**Take off.** Check for FAA, airline, and rail-travel announcements about Y2K compliance during the last few months of 1999. Check with travel agents and airlines for correct arrival and departure times, especially if traveling overseas.

**Tank up.** Fill up your gas tank before December 31, 1999, in case electric power or credit-card processing shuts down.

**Home computing.** Check out the status of your own computer system with the many free utilities that are available. Find out about the compliance of your software. Back up your system before 2000. Keep a paper printout of any contacts and schedules that you keep on the computer.

pens, they will not be able to leave the gate.

Our interdependent world guarantees that each initial failure will have a ripple effect. If telecommunications systems go down, so do banking and financial systems. If an oil refinery can't produce gas or heating oil, trucks can't move products, and employees can't work in cold buildings. If thousands of false fire and burglar alarms go off, firefighters and police cannot tell which, if any, are the real ones.

The Internet is a special case. Applications might fail. OSes might fail. Servers and switches might fail. In fact, there might be minor service blackouts all over the Internet, seriously affecting Internet-based businesses. Yet the Internet as a whole might stay up. After all, the idea behind the original Internet was to provide a highly redundant system of communication for military purposes. It still has that redundancy. Whether an Internet with 10 percent of its infrastructure out to lunch can support the current levels of traffic is an open question, however.

## Law and Disorder

In a society where people who spill hot coffee on themselves can successfully sue the hamburger place that sold the coffee, you have to expect that litigation—and lots of it—will be a big feature of this particular crisis. In fact, some estimates say that there will be two to three dollars spent on litigation for every dollar spent on fixing the problem. Company directors, senior managers, and IT personnel will probably be the main targets for litigation, regardless of the corporate structure. That might provide needed motivation for recalcitrant compliance.

The grounds for litigation are many and varied. Customers can sue suppliers for missing contracted deliveries or delivering noncompliant products. Suppliers can sue customers for not accepting noncompliant products. Consumers can sue vendors for practically anything. Stockholders or owners can sue managers for lost business due to noncompliance, or even for wasting money on compliance.

This can put enterprises in a weird double-bind. For example, one class-action suit against Software Business Technologies alleges that an older version of one of its many accounting products is not Y2K compliant. However, the latest version of the product *is* Y2K compliant. Common sense would suggest that those concerned about Y2K would upgrade to the compliant version. But this is litigation, not common sense.

What the litigants claim to want is a free compliant version of the *old* software. They claim that simply upgrading to the new version would require the hardship

**1999**

**July:** Six-month projections fail.

**July 1:** FY 2000 begins in 46 U.S. states.

**August 22:** Global Positioning System (GPS) rolls over from week 1024 to week 0001.

**September 1:** FY 2000 begins in the state of Texas.

**September 9:** "9/9/99": default "nonsense" date.

**September 23:** 99 days to year 2000.

**October:** Three-month projections fail.

## Some Products and Their Y2K Problems

| Product | The company says: | Scuttlebutt says: | Related tools |
|---|---|---|---|
| **IBM DB2** http://www.ibm.com/IBM/year2000/ | Uses four-digit year; IBM services can migrate you to DB2 version 4 or 5. | Earlier versions didn't support DATE, TIME, or TIMESTAMP column types. | Advanced Software Products Group's Date/2000; BMC Software's CM/Pilot; Micro Focus's SoftFactory/2000; Compuware's File-Aid/Data Ager |
| **Informix Dynamic Server** http://www.informix.com/informix/products/year2000.htm | Compliant. | Read up on DBCENTURY environment variable. | Relativity Technologies' RescueWare |
| **Microsoft SQL Server** http://www.microsoft.com/year2000/ | Version 6.5 and higher are compliant. | Service Pack 5 corrects three bugs. | Relativity Technologies' RescueWare; Mercury Interactive's TestDirector; Fidelity Technology Solutions' Tracer 2000 |
| **Oracle** http://www.oracle.com/products/servers/rdb/html/y2000.html | Oracle8 is compliant; Oracle7 should be upgraded. Free upgrade is available for Applications release 10.7 for maintenance-contract customers. | Default date format is DD-MON-YY; migrate to Application Suite 10.7. Be wary of version 11. | Relativity Technologies' RescueWare; Mercury Interactive's TestDirector; Magec Software's Magec Rapid Application Development System; Fidelity Technology Solutions' Tracer 2000 |
| **Sybase Adaptive Server Enterprise** (formerly SQL Server) http://www.eunet.pt/ano2000/sybase/year2000_matrix.html | Database itself is compliant; backup server is not. | One date-type range: 1900–2079; another date-type range: 1753–9999. Upgrade server to at least 11.0.3.2. | Relativity Technologies' RescueWare; Mercury Interactive's TestDirector; Cyrano's Migration Pack; Fidelity Technology Solutions' Tracer 2000 |
| **Apple Mac OS** http://www.apple.com/macos/info/2000.html | All versions are compliant until at least 2040. | Date & Time Control Panel doesn't accept years past 2019. | |
| **DOS** | IBM PC-DOS 7.0 and DR DOS are compliant. | Depends on BIOS; MS-DOS 6.22 is not compliant. | Greenwich Mean Time's Check 2000; Pleion Systems' PcCheck |
| **IBM OS/400** http://www.ibm.com/IBM/year2000/ | V3R2, V3R7, and V4R1 are compliant. | Older versions are not compliant; use windowing. | IBM's Search2000; TCS's Y2Kit/400; Into 2000's Into 2000 |
| **Microsoft Windows 3.x** http://www.microsoft.com/year2000/ | Compliant. | Not compliant; depends on DOS and BIOS. Needs new WINFILE.EXE. | |
| **Microsoft Windows 9x** | Compliant. | Not compliant; depends on DOS and BIOS. Needs new WINFILE.EXE and COMMAND.COM. | |
| **Microsoft Windows NT** | Compliant. | Depends on BIOS. | Unibol's Unibol36 and Go2000 |
| **Red Hat Linux** http://www.redhat.com/redhat/website.html#y2k | Compliant. | Compliant until 2038 (like other Unix-like OSes); depends on BIOS. | |
| **Sun Solaris** http://www.sun.com/y2000/ | Version 2.6 is compliant with free patches added. | Previous versions are compliant with patches for sale. | |
| **Novell NetWare** http://support.novell.com/search/patlst.htm | Versions 3.11 through 4.10 need patches. | Ditch anything before 3.11. | Multima's NetKeeper Express; Tally Systems' NetCensus; NetWare Enhancement Pack |

**October 1:** FY 2000 starts in the states of Alabama and Michigan.

**October 1:** U.S. federal government's FY 2000 starts.

**October 3:** 90-day projections fail.

**December:** One-month projections fail; 12/99 might be a "signal"; electrical generators sell out; hoarding begins.

**December 2:** 30-day projections fail.

**December 31:** Sometimes used as "Never Expires" date (IBM tapes are marked 99365—all could expire today);

Blue Friday: Largest one-day sell-off in stock-market history; long lines at ATM machines; support for much software might cease after

## Some Remediation Tools

| Product | Company | Platforms |
|---|---|---|
| **Navig8 2000** | Accelr8 Technology | Digital (various) |
| **CA-Fix/2000** | Computer Associates International | IBM MVS, OS/390 |
| **ConveRT/2000** | Computer Resources & Technology International | IBM AS/400, S/36 |
| **Xpediter+** | Compuware | Windows 95, NT; OS/2 |
| **CAU/400** | Excel Programming Innovations | IBM AS/400 |
| **SuperVisor** | Information Technology Specialists | IBM AS/400 |
| **TestTime/400** | InPro International | IBM AS/400 |
| **SoftAudit/2000** | Isogon | IBM MVS |
| **Vantage YR2000** | Peritus Software Services | IBM (various) |
| **Bridge 2000** | ViaSoft | IBM MVS |

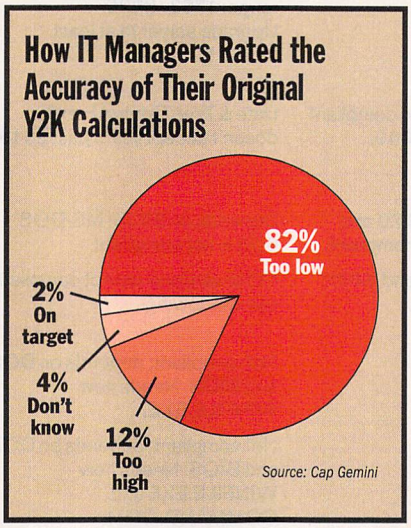
of testing the new software, changing interacting software, and so forth. (Never mind objecting that a compliant version of the old software might require the same things; that's just pesky common sense.)

So choose: Do you make compliant an old version you probably don't want to support (and which you thought you'd replaced with a compliant upgrade), do you settle the claims for money, or do you pay to defend against the claims? This classic lose-lose-lose situation is one that your enterprise could find itself up against.

Banks also seem to be prime candidates for litigation, possibly because that's where the money is, as Willie Sutton has apocryphally observed. Since most bank systems, including automatic teller machines, wire transfers, check clearing, and security vaults, all use computers, the potential for bank problems has a lot of people nervous. The FDIC has warned banks about possible problems and the looming prospect of litigation.

You often hear the term *due diligence* mentioned regarding this issue. This means that enterprises—and their leaders—had better be able to document their thorough and reasonable good-faith efforts to expose and fix Y2K problems. Meticulous record-keeping is a must. In fact, one criterion by which to judge software tools for assessment, remediation, and testing is whether they automatically keep records of all operations and outcomes.

Some in government have introduced legislation to limit the liability of enterprises with regard to Y2K problems. The California Assembly, for instance, was considering such a bill. Naturally, this helps most those who do the least. On the other hand, if a company diligently tries to become Y2K compliant, it would be unjust for it to suffer because of mere association with negligent noncompliers. Other states, including Nevada and Washington, have shrewdly passed legislation protecting the states themselves from such litigation.




**Y2K is more expensive than you (and IT managers at large companies) think.**

In fact, the U.S. government is abdicating any kind of leadership role in this crisis. Government agencies are among the worst-prepared in the country. The IRS (which has 100 million lines of code and received a D minus from the House Technology Subcommittee), FAA (completion date: 2009, an independent analysis indicated), and Department of Defense (No supplies to a bunch of armed guys is a problem?) are all way behind. Social Security was doing well until it realized that all the state systems with which it interacts are off schedule. What's 30 million lines of code, more or less?

It's no wonder that millennium insurance is becoming available from, among others, American International Group. If your enterprise faces a considerable exposure to risk if something goes blooey, you might want to check into this.

## Big Principles

The rest of this article assumes you haven't done diddley about Y2K yet. Unfortunately, you're not alone: Some 40 percent of American companies are dragging their feet, too. But don't panic; even though you probably can't accomplish everything in time, there are still some definite steps you can take to help your enterprise survive the big odometer rollover. In fact, there's a school of thought that says you're lucky you're late: You haven't had to put up with buggy remediation software, green consultants, and immature strategies.

Indeed, Y2K fixing is now a seasoned field. Software is tested and effective; consultants have a proven track record and clients you can investigate; and there are standard methods for handling each situation. So stop stalling and get working.

The first principle of getting through Y2K successfully is that your enterprise must survive. This might seem obvious, but it's the set of implications of this that

today, 1999/99/99: a really "nonsense" date.

**2000**

**January 1: Black Saturday** Computer passwords expire, locking administrators out of systems; noncompliant systems (fire alarms, heating systems, power grids, telephone routing and billing, medical care, military, air traffic, Internet, and financial exchanges) fail; incorrect bills are sent out; manual paperwork begins; unemployment drops; supply chains begin disruption; first casualties occur; litigation begins. Still twentieth century and second millennium.

**January 3, Monday:** First business day of the year 2000 in the U.S.

are disturbing. For example, it's not important that your IT department or computer systems survive Y2K. (Yes, you are reading this in BYTE.) It's more important that your enterprise survives. Ideally, of course, you want both to come through unscathed. This might involve outsourcing some or all of the processing you do. It might even mean—horrors—using manual and paper-based systems.

Another implication of this is that you might have to spend a pile of money. But you might *not* have to. Many clever enterprises have found ways to simplify their Y2K projects and get them done more inexpensively than experts have thought possible. For instance, just by using a customized version of Micro Focus's Revolve, Kemper Insurance slashed a $40 million estimate to about $700,000 for its 40-million-line-of-code databases running on an Apollo mainframe.

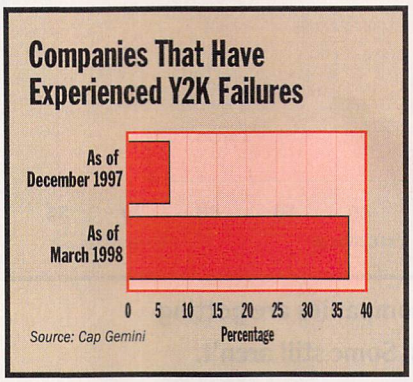
The second principle that you must accustom yourself to is reality. This is not one of those Hey-when-can-I-get-that-new-feature-Oh-I'll-get-to-it-next-week-type development projects. You need to do real planning with real numbers and real information this time. It might turn out that you cannot be ready in time, even after spending a reasonable amount of money and devoting a reasonable amount of effort to the project. If so, you need to know that and start looking to Plan B from the start. The one thing you don't want is to have a warm, rosy glow about the project, toss Plan B, and find out in November 1999 that there's no way you can finish in time.

You'll have the most trouble holding onto reality when you deal with outside consultants and hardware and software suppliers. Do not subscribe to their warm, rosy glows, either. After all, your enterprise's fate is in *your* hands. Why should you trust their Y2K-compliance claims? You must have the highest amount of confidence possible in anyone outside your organization in whose hands you place your enterprise. And put more faith in your own Plan B than in anything that you're trusting any outsider to do.

Possibly the most vital part of reality is enterprise-wide support. Everyone in the enterprise must know that Y2K survival is a priority. This is especially true for members of upper management, who would often just as soon ignore the problem and concentrate on "business as usual." By funding necessary Y2K projects, they might get to keep their enterprise. By stalling or ignoring the situation, however, they risk losing it all.

## Some Date-Location Tools

| Product | Company | Platforms |
|---|---|---|
| Year2000Plus | Ascent Logic | DOS |
| File-Aid/Data Ager | Compuware | IBM MVS |
| HourGlass 2000 | MainWare | IBM MVS |
| Platinum TransCentury Analysis for AS/400 | Platinum technology | IBM AS/400/OS/400 |
| Simulate 2000 | Prince Software | DOS |




**Many of 128 large U.S. companies have Y2K problems already.**

## Triage

One term you must understand thoroughly is *triage*. Peter de Jager first used it to pertain to Y2K, and it's very appropriate, especially at this late stage. Since you no longer have enough time to save every application in your enterprise, you must perform triage to decide what to save.

There are several triage strategies. Jerry Hermes, Micro Focus's Year 2000 consulting services manager, pragmatically uses a three-stage strategy: dying, dead, and soon-to-die. Another strategy emphasizes what can be saved: probably OK and no sense wasting effort on it; probably doomed and no sense wasting effort on it; and could save with effort. You, of course, would concentrate on the last category.

Yet another triage strategy emphasizes importance to your enterprise: not important; important but hopeless; and important and salvageable. Again, you would concentrate on the last category. What kinds of applications might you consider "not important"? E-mail—unless that's your only means of rapid communication. Internet access—unless you do a lot of business over the Web. Also, anything you can conceivably outsource: Payroll, order processing, and some human-resources functions are examples.

After identifying the critical systems you want to try to save, you must develop realistic plans to save them. You might call in outside project-planning experts if you don't have an active internal IS shop. There are also software packages to help you plan and estimate your Y2K projects, including Software Productivity Research's Checkpoint and SPR KnowledgePlan.

You must include realistic schedules—not dreams—in your plan. You create them based on estimates of the amount of work to do (in terms of lines of code or function points), knowledge about how problem-fixers do in similar situations,

**January 4, Tuesday:** First business day of the year 2000 in the U.K.

**January 8, Saturday:** The first "We Survived" party is held.

**February 1:** The second "We Survived" party is held.

**February 29, Tuesday:** Some major software packages do not think this date exists. Some say that some PDP-11 computers will not boot after this date.

**March 1:** Some leap-year errors might not have appeared yesterday.

**2001**

**January 1:** Third millennium and twenty-first century start.

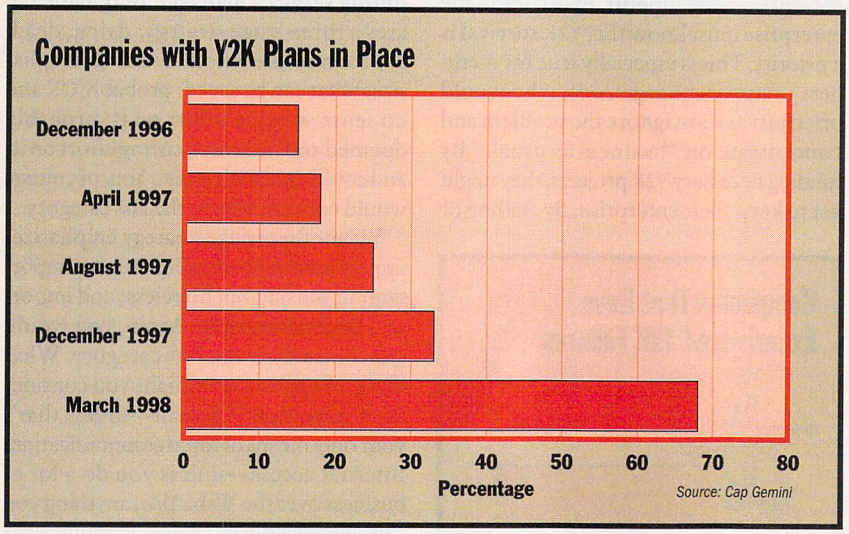
**February 29:** Will not exist.

**2002**

Transition to the Euro is completed within contiguous Europe.

and the amount of resources you can devote to Y2K. If the result is too frightening, you must adjust some of these parameters: You can perhaps reduce the number of systems you'll try to fix, find better problem fixers, or turn more resources over to the Y2K problem.

You'll probably also want to develop a "compliance tracking" strategy involving configuration management and quality assurance (for which there are also software packages). Capers Jones, chairman of Software Productivity Research (Burlington, MA), has identified bad fixes as one of the major problems with Y2K remediation, with one of the worst removal efficiencies. "The bad-fix injection rate is seldom discussed in Y2K literature, but it's likely to be just as troublesome as it is for other kinds of software errors," he says. The last thing you want is to reintroduce fixed problems into your system.




**The good news: More companies are getting ready. The bad news: Some still aren't.**

## Fixing the Hull

Let's address hardware first. You need a system-management database of all your computer hardware—including network devices, such as hubs and routers, and peripherals, such as printers and scanners. Your prime sources for information about your equipment should be the manufacturers who made it and the vendors who sold or leased it to you. The manufacturers should know what is Y2K compliant and what isn't. If your hardware isn't compliant, they should have options mapped out for coping with it.

In addition, there might be user's groups that have Y2K information, as well as user-coping stories. You might also find free software to test for problems—and even solve some of them (see the text box "Free Y2K Software" on page 59). Yes, solve. For some systems, including certain PCs, there are software utilities that, for example, intercept calls to the system clock and can return changed (correct) years in the 2000s from actual (incorrect) years in the 1900s. You should regard these solutions as temporary until you can fix or replace the hardware. You must also be aware of the limitations of these temporary solutions and test to be sure they're not creating more problems. Naturally, all of this is platform-dependent.

At some point you must decide whether to upgrade or replace the hardware. (For example, upgrades for Y2K compliance on a PC system might include replacing the BIOS and system-clock chip sets.) You should work with your vendors on these options—unless they are totally clueless about Y2K, in which case you should immediately start working with other vendors. You might have some leverage with vendors if items are currently under warranty: Your line of argument is that noncompliant hardware cannot fulfill its intended task, since you require something that can survive a simple year change. (Do not wait until 2000 to make this argument; it's valid now.) Plus, savvy vendors should have plans in place to accommodate fixing and replacing equipment.

The fix/buy decision is not a simple one: There's more at stake than cost. Many enterprises are choosing to use this crisis as the occasion to discard some antiques and move up to more capable hardware that's easier to support and find software for. For others this might be desirable, but out of the question financially. Whichever course you choose for each noncompliant piece of hardware, keep in mind that you must thoroughly test fixed or new items with existing—and soon-to-be arriving—software and other hardware already present. Do not expect no-problem plug and play.

Embedded systems are a special case. They might be located within manufacturing systems and almost any type of sensor or monitoring system. Your safest course is to consult with the manufacturer of the equipment containing the embedded system. Not only will it know whether a given item is compliant, it might have programs to replace the noncompliant embedded system, or it might replace the item containing the embedded system.

Software fixes are generally not possible with embedded systems. You don't have a lot of choices here.

## No Quick Fixes

There are many ways to fix the Y2K problem with regard to software. If we knew

**2002**
**January 1:** Burroughs Unisys A Series system date fails?

**2005**
Some really old versions of Unix (e.g., 16-bit BSD) die this year?

**2009**
FAA finishes its Year-2000 preparations (U.S.).

**2020**
**January 1:** Systems still using 1920 as a pivot year fail.

**January 1:** Macintosh (System 6.0.4+) Date & Time Control Panel can no longer set the current date.

**2023**
**December 23, Sunday:** End of the world, according to the Mayan calendar.

**2030**
**January 1:** Systems still using 1930 as a pivot year fail.

where every occurrence of the offending code were, any one of us could solve the problem. But how do you find every date reference in compiled code, especially in systems whose source code and listings are just a dim memory?

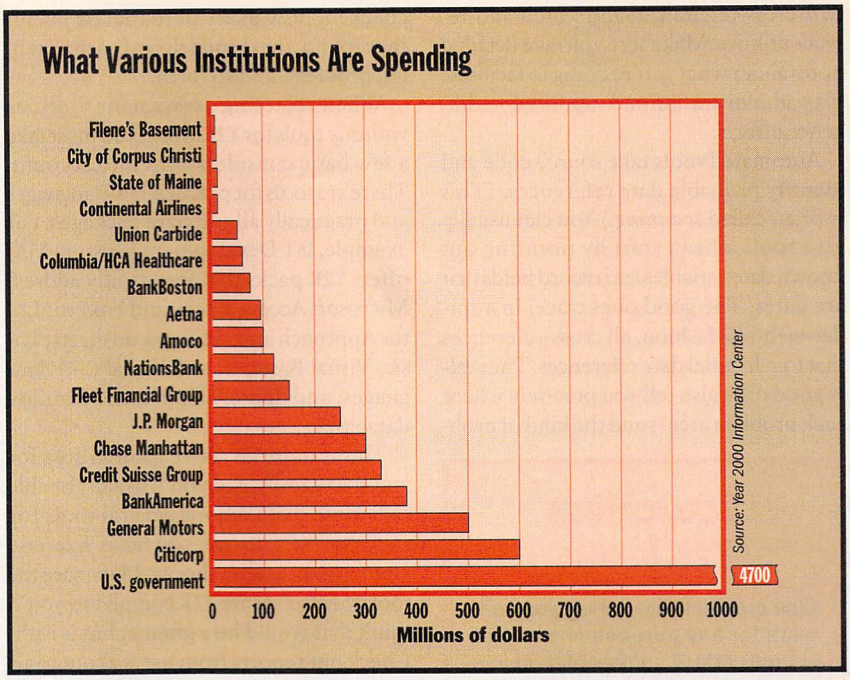
This essential step is called analysis, or assessment. For each priority application, you must analyze the software to find Y2K-impacted date references. If you obtained your software from another source, the manufacturer or vendor probably has information about Y2K compliance and possible options. (User's groups might also have valuable information to share.) In this case, the assessment phase is all done, and you can move on to deciding how to handle any problems.

If the software is proprietary or was developed in-house, however, you have a greater burden. (One thing to keep in mind is that some items that seem like data are actually software. An example is a spreadsheet: Although it seems like data, it's actually a nonprocedural computer program.) Keep in mind that not all date references are important. Only those that involve a calculation or a comparison—and the references that lead up to these—are significant. Merely storing, retrieving, or displaying a date doesn't matter.

In addition, as Micro Focus's Hermes points out, the context of dates is important. For example, 98 as a birth year could refer to either 1898 or 1998, while 98 as a car-purchase year almost undoubtedly refers to 1998.

You face several choices for assessment. You can either get outside help or do the work internally. As with all other steps outlined here, a few observations pertain to using outside help versus working internally. First, as SPR's Capers Jones has determined through extensive analysis of software projects, it's usually less expensive to do the work internally, assuming you have an active IS department. Second, if you're concerned about security, tread carefully with outside assistance. Third, doing such specialized work internally might require specialized training, which adds to the expense and reduces the time available to assess and fix problems. Fourth, outsiders with real expertise might be able to do certain tasks in a fraction of the time it would take you to do them internally; you might be able to trade dollars for time. Fifth, you must investigate the track record of any outside help you consider: Are their previous clients satisfied? Sixth, you must define what you want done very carefully and ensure you're not leaving out some vital step. Finally, you must establish some form of supervision and accountability with your outside help.

If you decide to do the work in-house, you need to decide whether to perform it manually or with some of the many assessment tools that are available. Manual methods are labor intensive, but at least you have a thinking brain doing the work. You'll probably use text-search systems—the more sophisticated the better—along




**Fixing Y2K takes time and money. How much? If you're the U.S. government, $4.7 billion.**

## Free Y2K Software

**Unibol's free vulnerability analysis of System/36 code**
See http://www.unibol.com

**IBM's Fix Pak for PC DOS 7.0**
See http://www.software.ibm.com

**Novell's NetWare 3.12 and 4.1 patch**
See http://www.support.novell.com

**COBOL impact-analysis software**
See http://www.doitnow.com/~commtec/down.html

**PC tests**
See http://www.schoolhs.demon.co.uk/date2000.htm; http://www.survive-2000.com/eval.htm

**To fix PC BIOS problems**
See http://www.RighTime.com/

**2036**
**January 1:** Burroughs Unisys A Series system date fails?

**February 6:** $2^{32}$ seconds from January 1,1900.

**2038**
**January 19:** Unix: $2^{31}$ seconds from January 1, 1970.

**2040**
**February 6:** At 06:28:16, old Macs' longword seconds from January 1, 1904, overflow.

**2042**
**September 17:** IBM 370 TOD clock overflows.

**2044**
**January 1:** MS-DOS: $2^{6}$ years from 1980, setting the most significant bit (MSB). Signed variables using this get a negative date.

with cross-referencers and search-and-replace utilities. Make sure you take detailed notes about what you're doing to facilitate plan administration and support due-diligence efforts.

Automated tools take source code and identify probable date references. (This is often called *scanning*.) You can usually give tools a head start by pointing out known date variables and record fields that are dates. The good ones trace, in a spider-web-like fashion, all cross-references that touch initial date references. The really good ones also tell you precisely where each problem area is and the kind of problem it is (e.g., calculation or comparison).

The extremely good ones, meanwhile, prioritize which references you probably need to change and which ones you can ignore (and even which ones it's not sure about or can't check because the file is classified or in use). The even-better ones suggest which changes to make in the code and might allow you to do global replacements or wait for permission to make each change. The best ones also keep careful due-diligence records about how many files and how many lines of code they've checked, how many potential problems they found, the disposition of each potential problem, and so forth.

When selecting assessment tools, as with any tools for Y2K work, you must take a few basic considerations into account. There are tools for practically all languages and practically all software packages. For example, IST Development (Boston, MA) offers Y2K packs that specifically address Microsoft Access, Excel, and FoxPro; Lotus Approach and 1-2-3 spreadsheets; Basic, Visual Basic, C, and Visual C++ languages; and dBase, Clipper, and Paradox databases.

This is quite an active growth area for automatic tools, and you'll usually be able to choose from among several tools for each type of software you have. Exercise your options and be choosy. Make sure the tools themselves are Y2K compliant; you'd think that would be a gimme, but it isn't. Check out reports from users about tools before you buy; there's crummy Y2K software, just like there's crummy any other kind of software.

In addition, know the platform needs of the tool itself: Your software might be sitting on a mainframe, but the tool might work under Windows NT, so you'll have to port the code to check it out. Be on the lookout for multipurpose tools that assess, fix, and test code; they can save you a lot of grief. For example, Micro Focus's SoftFactory/2000 is useful through all stages of Y2K fixing for COBOL, PL/1, and assembly language source code, according to Adriana Ozgencil, the company's marketing communications manager. Finally, hang onto any assessment tools you use; you'll use them again after the fixing is done, during the testing stage.

Do you have legacy systems with no source code? No problem—or, at least, no insurmountable problem. There are tools that take machine code and translate (or unassemble) it into higher-level code, such as COBOL or C. Highly dependent on the CPU and OS, these tools are very nichey. Sourcer, from V Communications, is probably the best known. See the table "Sourceless Y2K Fixers" at left for more.

You then feed this newly minted source code into the assessment tools. Admittedly, you end up with variables with names like AAA075, but that doesn't matter to most assessment tools. They're looking at where the variables come from and what they're used for, not what they're named.

## Sourceless Y2K Fixers

One problem with debugging software for any purpose is a lack of source code. A number of products can disassemble (or unassemble or discompile) assembly language, machine code, or executable files into source codes. You can then perform Year 2000 assessment on the resurrected source code.

| Product | Company |
|---|---|
| **AvCase II 68xxx (V.4.10)** | Avocet Systems |
| **DISxx** | Logisoft |
| **DOC COBOL/400, DOC RPG/400** | Source Retrieval |
| **Sourcer (V.6.5)** | V Communications |

## Dry-Dock Repairs

Once you've done your assessment, you are ahead of the game on two counts: You now probably have a better idea about the scope of your Y2K projects, and you should also know which places to concentrate on first. At this point, you might wish to redo your project plan. You might, in fact, find that you don't have as much to do as you'd originally thought, and you might consider working on some less-critical systems. This is fine, as long as the main thrust of your effort remains the critical systems.

The fixing (or remediation, or renovation) phase involves decisions similar to those done during the assessment phase. But an additional set of choices presents itself here. If you acquired the software from somewhere else, you can either fix it or get new software. If you decide on the latter, you need to choose whether you want a newer, and hopefully more compliant, version of the same software or another package altogether. Even if you have software that your enterprise developed, you may well have this option available. There are few functions of a proprietary system that some commercial system cannot duplicate.

In this phase, if you decide to fix problems, you have to be even more paranoid about your choices because you're changing actual code. You must be vigilant about not introducing further harder-to-find errors into software that's (relatively) problem-free except for the date problem.

Unfortunately, simply upgrading does not always solve problems. IST Development's Falcon indicates that when you

**2046** **January 1:** Amiga system date failure.

**2046** **June 8:** Some Unix password aging fails; $64^2$ weeks from 1970.

**2049** **December 31:** Microsoft Project 95 limit.

**2078** **December 31:** Excel 7.0: The Last Day.

**2079** **June 6:** $2^{16}$ days from January 1, 1900.

**2080** **January 1:** MS-DOS file dates, displayed with two-digit years, are now ambiguous.

**2100** **January 1:** Y2.1K: most current PC BIOSes run out of dates; MS-DOS

## Y2K Statistics

- Number of Americans who might not get their tax refunds in the year 2000: 90,000,000 (IRS)
- Percentage of U.S. government's revenue stream in peril: 95 (IRS)
- Number of medical devices that could be affected: 10,000 to 15,000 (Hospital Council of Western Pennsylvania)
- Estimate to fix U.S. Y2K problems: $600,000,000,000 (GartnerGroup)
- Estimated legal costs regarding Y2K: More than what it cost to fix it (ABA)
- Average cost of repairing source code for a Fortune 500 company: $30 million (Brown & Bain, Phoenix)
- Amount the U.S. government will have to spend to fix or replace its systems: $3.8 billion (U.S. government)
- Number of "bug busters" to be mobilized by U.K.'s PM Blair: 20,000
- U.K. "Action 2000" project budget: $28,500,000,000
- Total cost of Y2K fixes: $3,600,000,000,000 (Software Productivity Research)
- Total cost of Y2K fixes: $52,000,000,000 (BZW, U.K.)
- Number of programs in Pennsylvania state government needing correction: 44,228 (PA state government)
- Number of hours needed to make those apps Y2K-ready: 1,298,310 (PA state government)
- Cost to make those apps Y2K-ready: $38,083,123 (PA state government)
- Amount of work completed on those apps: 59% (PA state government)
- Percentage of mainframe resources dedicated to solving Y2K problems: 10 to 25 (various sources)
- Percentage of companies that say they've completed Y2K assessment in SEC filings: 60 (Triaxsys Research)
- Organizations that will experience a failure: 30% to 50% (GartnerGroup)

move from Excel 4 to Excel 5, for example, the method used for year-handling is different for newly added data. Spreadsheets that were fine on 4 break on 5. The same is true when moving from Access 2.0 to Access 97.

This example brings up another aspect of Y2K that's most noticeable when you're considering a software upgrade. A piece of software might be compliant due to its use of pivot years: A pivot year of 1920 means that years ending in 20 through 99 are in the 1900s, and years ending in 00 through 19 are in the 2000s. But when a year like 2020 turns up—and it will—the program still thinks it's 1920. Such "compliance" is only a temporary solution.

Similarly, there are a number of methods to fix Y2K problems in code. These include rewriting the application (a good opportunity for a 30-year reunion of the COBOL cowpokes who wrote the original code), windowing (or pivoting, as described above), coding dates in binary (e.g., a 1-byte field could hold 0 through 255 rather than 0 through 9), and even pulling the plug on the application.

However, with so little time left until 2000, there are only a few methods that will get you through the transition safely. (Capers Jones has studied this problem in great detail; I quote his findings here.) One such method is year interception, where each year reference becomes a machine-code subroutine call that returns the correct number. (One hitch to this method is that no one is sure if it will work, even though people such as Bob Bemer, the person who named COBOL, are behind it.) Another method is year-shifting by, say, 28 years, so 2000 appears as 1972. (This odd choice of shift preserves leap years.)

Note that, like pivoting, these are only temporary methods. The only true, long-term, iron-clad software fix is year expansion: changing every year from two digits to four. Everything else is a temporary fix that you'll need to redo. And if you choose a temporary fix, you might still need to expand 15 percent to 20 percent of the dates, according to Micro Focus's Hermes.

## Before Midnight

Testing is the most important part of the Y2K process. There are many types of testing, on different levels of applications and data. Capers Jones recommends formal code inspections, formal test-case inspections, unit testing, regression testing, integration testing, performance testing, system testing, and extended testing with lazy clients and suppliers. Hermes regularly uses "touchpoint" testing: testing those things you've changed.

Naturally, you want to test in an environment that simulates Y2K conditions as closely as possible. Depending on what you're testing, this could involve transitioning the system from 1999 to 2000 (to see if there are any date discontinuities); receiving times and dates within 2000; and using typical kinds and amounts of data with dates of 2000.

There are tools for enabling testing in many ways. Date simulators fool a system into thinking the date is different from today's date. More sophisticated data agers can wiggle dates around to ensure, say, that all data falls on a weekday. As mentioned earlier, one part of your testing should include the assessment tools you used to find problems in the first place (see the table "Some Assessment Tools" on page 62). The problem count should be zero.

## Plan B

What if you don't finish your Y2K project on time? Or what if you finish on time, but your computer systems go south as you come to the year 2000? It's time to transition to Plan B: your contingency plan.

Consider a retail business as a simple example. Its contingency plan might include putting pads of receipts, pencils and pens, sales-tax-lookup tables, and printing calculators at each register, plus may-

DIR renders the file-date years 2100 through 2107 as 99.

**2106** **February 7:** Unix: $2^{32}$ seconds from January 1, 1970; time overflows at 06:28:16.

**2108** **January 1:** MS-DOS: $2^7$ years from 1980; file date overflows.

**2738** **November 28:** Approximate day of A.D. 1 million.

**4338** **November 28:** Cobol-85 integer day 1,000,000 exceeds six-digit field 9999: HTTP caching fails.

**10000** **January 1:** Y10K: four-digit years fail.

## Some Assessment Tools

| Product | Company | Platforms |
|---|---|---|
| **Date/2000** | Advanced Software Products Group | IBM (various) |
| **AI Management Assistant** | Altech Research | IBM AS/400 |
| **Milligration** | American Software | IBM AS/400 |
| **TF2000** | Boxware | Windows 95, 3.x; DOS |
| **Restore 2000** | CACI International | Windows 3.x |
| **CA-Accuchek** | Computer Associates International | IBM/MVS |
| **ESP Dateline 2000 Test Bench** | Cybermation | IBM/MVS/ESA |
| **Date/2000** | Date/2000 | IBM AS/400, S/36, RS/6000 |
| **Pathfinder for AS/400** | Hawkeye Information Systems | IBM AS/400 |
| **IBM VisualAge 2000** | IBM | IBM (various) |
| **NATrace for C, NATrace for COBOL** | New Art Technologies | Windows 95, NT, 3.x |
| **Control-I/2000** | New Dimension Software | IBM OS/390 |
| **Tool-Time 2000** | R&L Software Associates | IBM AS/400 |
| **Automated Test Facility** | Softbridge | Windows 95, NT |
| **Insight 2000 Toolkit** | Software AG of North America | Windows 95, NT; Unix |
| **Millennium/400** | Visionet Systems | IBM AS/400, S/3X |

be providing a brush-up course on simple math for the cashiers.

Clearly, the main alternatives to computer systems are manual and paper-based systems. Each department should estimate how many human beings it will take to do what computers do now. Extra shifts might be necessary.

For paper-based systems to work, you will obviously need paper. Plan on keeping paper records for the last period of 1999 so that you'll have something to work from. Keep a printout of the November and December payrolls so you can generate an approximate January payroll if you have to. Have a printed list of contacts for every customer and supplier; include all phone numbers and actual physical addresses. Have procedures mapped out for billing, invoices, payroll, accounting, sales administration, and anything else your computers routinely handle.

## After the End

Don't plan on heading for Disney World after the end of 1999 quite yet. There will still be plenty to do after the transition process is completed, depending on how your enterprise has handled the Y2K situation. This includes:

- If anything broke, fix it.
- If you employed temporary fixes, such as pivoting—or if you changed to commercial software that has temporary methods—start planning on either fixing the applications with year expansion or changing to year-expanded commercial software.
- If you have noncompliant hardware that you fixed using a software solution, such as intercepting system-date calls, you should start thinking about replacing the hardware.
- If you have noncritical application systems that you never bothered to address, it's time to start the whole Y2K process for them at this point.
- Do another full assessment of all your systems to make sure there aren't any hidden problems.
- Start thinking about future date problems that will occur with your computers (see the Time Line).

## Sailing into the Sunset

So, it's all grim, right? Yes, mostly, but not entirely. Many enterprises are using the Y2K problem as a motivation to make other needed changes to their computer systems. For instance, they're doing such things as upgrading hardware to newer machines, tossing legacy applications for newer software, switching from in-house and proprietary systems to off-the-shelf solutions, and improving the quality and security of their systems. These are all positive responses to a negative situation.

Sure, fixing Y2K is like learning to swim in order to escape a sinking ship: There are more pleasant ways to achieve the same result. But given the situation, doesn't it make sense to leverage necessity to your advantage? With the right spin on this process, you could well emerge from the Y2K dilemma with better computer systems and a more viable enterprise—a happy ending worthy of Hollywood. B

*Edmund X. DeJesus is a BYTE senior technical editor. You can reach him by sending e-mail to* **ed.dejesus@byte.com.**

**29602**
**January 1:** Microsoft Windows NT File System (NTFS) fails.

**29940**
New Macs' signed 64-bit time fails (has been OK since 30,081 B.C.).

**31086**
**July 31:** Internal Digital Equipment VMS time fails at 02:48:05.47.

**60056**
Win32 64-bit time fails (started from January 1, 1601).



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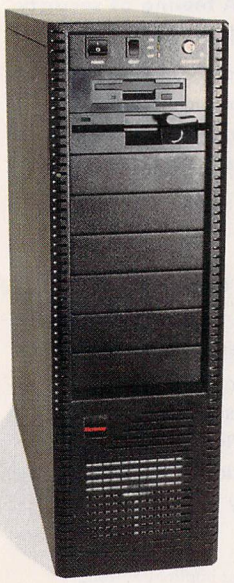
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*"Literally everything runs profoundly faster on the Screamer."*

***PC Computing - July, 1997*** ★★★★
*Microway's Screamer . . . "is, quite simply, the fastest Windows NT machine on the planet. . . The performance leader."*

***Desktop Engineering - September, 1997*** *Product of the Month*

***Computers in Physics - September, 1997*** *Product of the Month*

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POWER PQ QUEST

# MANAGING PC COSTS

*We identify at least five hardware and software solutions that enable best practices through a common framework exposing the big picture.*

*By Mike Hurwicz*

For many years, most of us have been aware that a computer's true cost is more than just what you paid for it. The total cost of ownership (TCO) for that system includes the hardware, software, and, most of all, the support. In fact, the hardware is by most estimates only one-fifth of the TCO.

To reduce the TCO, it makes sense to attack the other four-fifths, where you'll get the biggest bang for the buck. Solutions here have typically been to drastically limit what end users can do with their systems. Locking down software and hardware so users can do only what they're authorized to do definitely cuts the TCO. But it also defeats some of the power of the PC—the freedom to experiment. Whether it's experimenting with a new set of macros in a spreadsheet or installing personal-productivity software, users often get benefits from customizing their systems without bothering IS.

## Best Practices and Java

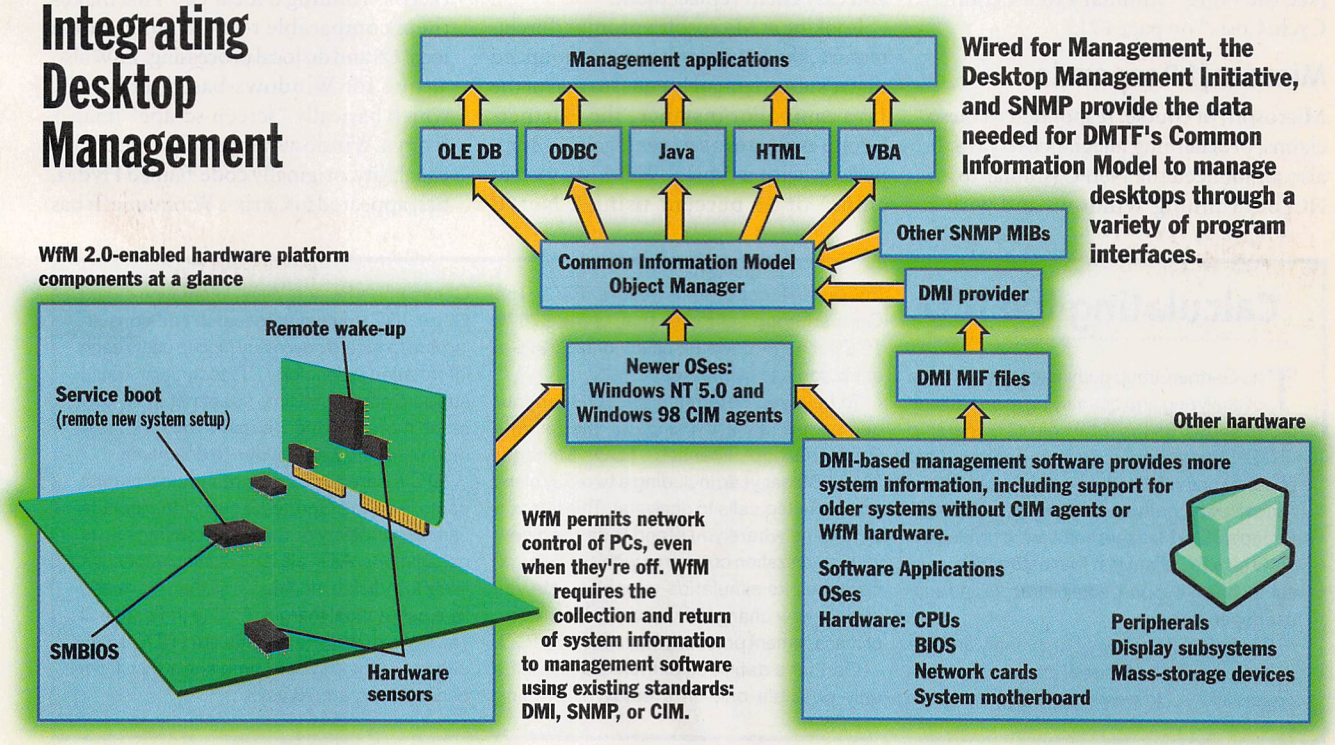
Recognizing this conflict, IS organizations are looking increasingly to system analysis and management tools to lower their TCO. While controlling the TCO depends on some very human factors, more and more products are being built with the TCO in mind.

There are several ways to measure the TCO (see the text box "Calculating the TCO" on page 66). But no matter how you measure it, TCO reductions are typically achieved through special client hardware and, more important, improved management practices. The GartnerGroup estimates that by implementing best practices, without any special hardware, organizations can cut 26 percent off Windows 95's TCO. Special hardware kicks that number up to about 35 percent.

Implementing best practices is complex. It requires detailed planning and analysis; technology like automatic discovery and inventory, electronic software distribution, remote diagnostics, remote control, and help-desk automation; and process improvements and people-oriented improvement based on training.

*continued*

## Integrating Desktop Management




**Wired for Management, the Desktop Management Initiative, and SNMP provide the data needed for DMTF's Common Information Model to manage desktops through a variety of program interfaces.**

The Java camp (primarily Sun, IBM, Netscape, and Oracle) is one of the most vocal proponents of one set of best practices. It tried to use the TCO as a weapon against Windows. This camp argues that centralized management and fewer opportunities for users to make mistakes will give you a lower TCO than Windows clients with their limited support for centralized management.

The client hardware platform favored by the Java camp is the network computer (NC). This is a sealed box, subject to little or no user configuration (i.e., locked down), running a Java virtual machine (JVM) in a browser or on a simplified OS. The client automatically downloads applications and configuration information from the server, facilitating central management.

You can cure any software-related problems on the client by rebooting. Hardware problems are much less likely, because the client has no moving parts other than a power switch and (usually) a fan. But if a machine fails, you put in a new one and go back to work; because all clients are similar, it's easy to keep hot spares.

The GartnerGroup estimates that a minimal-function NC (i.e., running only an e-mail client and one business application) can reduce the TCO 34 percent in comparison with a typical "fat" Windows 95 machine running multiple applications (see the table "Summary of TCO Life-Cycle Costs" on page 67).

## Microsoft Responds

Microsoft, of course, responded to these claims, proclaiming allegiance to Java. It also announced the NetPC (similar to an NC, but running Windows and with a local hard drive for caching) and the Zero Administration for Windows (ZAW) initiative to provide software functions to reduce the TCO. Like the Java camp, Microsoft targeted automatic system update and application installation, central administration, system lock down, and easy client replacement.

Looking at Microsoft's promised architecture, the GartnerGroup pronounced that it's approximately equal to that of the Java camp. For instance, the GartnerGroup estimates a savings (again, in comparison with a typical Windows 95 machine) of 35 percent using a NetPC running Windows NT 4.0 and Microsoft's Zero Administration Kit, or ZAK (which automates the setup of desktop clients, monitors hardware and software installation, and lets administrators set user policies remotely).

The GartnerGroup's numbers are for NetPCs running a local OS. This makes them comparable to NCs, which run a local OS and do local processing. ZAW also allows for Windows-based terminals, which basically "screen-scrape" images from a Windows terminal server. This capability, originally code-named Hydra, first appeared in Citrix's WinFrame. It has

## A TCO Technology Glossary

**CIM**–Common Information Model: A Desktop Management Task Force (DMTF) standard that defines an object-oriented approach to modeling network and systems management information. CIM is founded on a meta-model that is used to express a management schema. It also includes schemata that conform to the CIM meta-model.

**DMI**–Desktop Management Interface: A DMTF standard that defines an architecture and a number of Management Information Format (MIF) files for tracking management information on desktops.

**HMMP**–HyperMedia Management Protocol: A protocol proposed for WBEM. HMMP operates on managed objects that conform to the meta-model defined by CIM. Many HMMP servers will probably implement portions of the CIM management schema.

**WBEM**–Web-Based Enterprise Management: From the WBEM consortium, it defines an architecture, a management schema that conforms to the CIM meta-model, and a protocol (HMMP), for managing all networks and systems in an enterprise using a Web browser.

**WfM**–Wired for Management: An umbrella term for all Intel's total-cost-of-ownership (TCO) initiatives. WfM Baseline provides a minimum expected set of management capabilities for PC designers and management application vendors. It focuses on hardware/firmware-based capabilities such as remote wake-up, Preboot Execution Environment (PXE) on clients, hardware sensors, and BIOS-based capabilities.

**ZAW**–Zero Administration for Windows: Microsoft's term for its initiative to provide software-focused TCO-reducing functions, such as policy management, inventory, software distribution, and client-side caching.

## Calculating the TCO

The GartnerGroup dominates the business of analyzing and quantifying the nebulous factor known as the total cost of ownership (TCO). Its numbers come from analysts' field observations validated, where possible, by historical data gathered using the GartnerGroup's TCO Manager software. It divides the TCO for a PC client into four categories: capital, technical support, administration, and end-user operations.

Capital costs are easy to quantify and are therefore the initial focus of attention for most organizations. However, they are by no means the largest contributor to the TCO. The GartnerGroup estimates that, of the $7872 TCO for a Windows 95 client, only $2376 is attributable to capital costs.

To help you determine the TCO for your company's assets using its model, the GartnerGroup licenses TCO Manager ($19,000 per year, including a two-day class and unlimited calls to analysts). This lets you determine where you stand today and how your organization compares with similar organizations. Its simulation capability lets you explore how changes in hardware, software, or management practices may affect the TCO.

Gartner's definition of the TCO is not the only possible one. In a study of Sterling Commerce's RemoteWare, International Data Corp. (IDC), a market research and consulting firm, counted how many mobile users each information technology (IT) technician could support, how much time spent per task, how much more productive users are, and how much revenue was lost due to downtime.

IDC's categories do not include capital costs. And the GartnerGroup didn't include user productivity or downtime savings in its calculations. All in all, IDC's calculations are likely to indicate more savings than Gartner's by a substantial margin. As one indication, if you leave downtime savings out of IDC's calculations, the payback time shoots up from nearly 45 days to 78 days.

since evolved into NT Server 4.0, Terminal Server Edition, which should be shipping by the time you read this. The capability may be built into the standard version of NT 5.0.

Now, both sides are scrambling to put substance to their initiatives. It's proving more difficult than either side imagined, and those capabilities that are available have not yet been widely deployed. Java itself as an OS has not yet achieved widespread critical mass. Java platforms and applications are not yet as robust as their Windows counterparts. Few applications have been ported entirely to Java.

## Microsoft's Time Line

Here's a time line of Windows TCO-control functionality as it exists and as it has been promised for the future.

Windows 3.1: The GartnerGroup estimates that the TCO for Windows 3.1 is about 10 percent higher than the reference Windows 95 platform. Microsoft's solution is its Systems Management Server (SMS), which provides automated software distribution and upgrades, hardware and software inventory of each machine, and troubleshooting/diagnostics via protocol analysis, remote control, and remote diagnostics.

Microsoft says SMS 2.0 will be easier to use than the maligned version 1.2, will support Novell Directory Services (NDS), and will integrate all administration into the new Microsoft Management Console (MMC). It will also include metering, which you can use to ensure that users run only permitted applications, preventing problems and increasing productivity. SMS 2.0 may ship in the fall.

Windows 95: Windows 95 also supports SMS. In addition, Microsoft built policy management features into it. Policies can reduce technical-support calls and enhance user productivity by preventing users from doing things such as unintentionally deleting necessary system files or incorrectly modifying the control panel or registry; introducing incompatibilities, viruses, or lost productivity by installing new software; and changing system settings such as colors, backgrounds, and desktop arrangement.

To help Windows 95 and NT client administrators, Microsoft provides ZAK, a free set of utilities and documentation to help IS departments implement Windows policy management features. However, Windows 95 is typically loosely managed, according to GartnerGroup analyst Bill Kirwin. Most organizations that are serious about locking down workstations are going to NT.

Windows 98: Microsoft says Windows 98 will provide significantly better reliability and uptime than Windows 95, reducing support calls by 20 percent to 25 percent. Only after Windows 98 has been out for a while can its claims in this area be verified, of course. Windows 98 will also include a registry checker and a system file checker, to get better insight into problems involving those resources.

Microsoft does not know yet whether IntelliMirror, an OS feature that replicates all the client's local data, disk contents, and state back to the server, will be a feature of Windows 98. IntelliMirror makes it possible to store all workstation files and applications on a server, while getting high performance by temporarily downloading those files to the workstation's local hard drive for the duration of the network connection. This also makes it possible, if a workstation fails, to swap in another one and go back to work immediately.

The uncertainty over the inclusion of IntelliMirror makes it difficult to estimate the TCO for Windows 98. The GartnerGroup does not include Windows 98 in its TCO estimates.

Windows NT 4.0: NT 4.0, which, like Windows 95, supports policy management, ZAK, and SMS, is currently the preferred platform for organizations that want to lock down workstations. The GartnerGroup estimates that a NetPC running NT 4.0 as a single-function browser-based terminal with ZAK will reduce the TCO 35 percent over loosely managed Windows 95. Running with full application support, the same configuration will reduce the TCO 21 percent. And running on a regular PC, as opposed to a NetPC, brings it down to 18 percent.

Windows NT 5.0: NT 5.0 will definitely have IntelliMirror, which will be enabled by Active Directory. This will provide a single, organized, network-wide system for storing all client configuration information, rather than just having multiple disk-image files on multiple servers.

Network managers will also be able to apply policies in a more granular fashion, says Microsoft product manager David Hamilton. With IntelliMirror, the system manager could let a user launch the control panel and change the computer's wallpaper and sound settings but not the IP address.

Running NT 5.0 on an ordinary PC, the GartnerGroup forecasts TCO savings of 21 percent compared to Windows 95. Running on a NetPC, the forecast is 25 percent. (Both these are with full application support.) Gartner does not have a number for NT 5.0 as a single-function browser-based terminal.

These numbers are only a few percentage points better than corresponding numbers for NT 4.0. Bottom line on NT: a more powerful, full-featured OS, requiring a more expensive hardware platform,

### Summary of TCO Life-Cycle Costs

| Annual costs by category | Java-based network computer, single function plus e-mail | Windows terminals, single function plus e-mail | NetPC running NT 4.0 with ZAK in TaskStation Mode |
|---|---|---|---|
| **Desktop annual costs** | **$4278** | **$3968** | **$4342** |
| Desktop capital | $1490 | $1220 | $1465 |
| Technical support | $793 | $772 | $877 |
| Administration | $434 | $412 | $436 |
| End-user operations | $1561 | $1564 | $1564 |
| **Network annual costs** | **$2267** | **$2291** | **$2128** |
| Network capital | $686 | $752 | $617 |
| Network technical support | $694 | $675 | $628 |
| Network administration | $311 | $288 | $307 |
| Network end user | $576 | $576 | $576 |
| **Total costs** | **$6545** | **$6259** | **$6470** |
| Reductions (Windows 95 base) | 34% | 37% | 35% |

Source: GartnerGroup

but actually costs a little less to own overall. In addition, says Kirwin, the GartnerGroup is being conservative about NT 5.0, because no one has seen IntelliMirror in action yet.

Note that IntelliMirror requires an IntelliMirror-compatible version of Windows on both clients and servers. This will delay or prevent deployment for many organizations. Novell is taking advantage of the long wait for IntelliMirror to directory-enable the current manageability features of Windows. (See the text box "Z.E.N.works Does ZAW One Better" on page 69.)

## Intel Chimes In

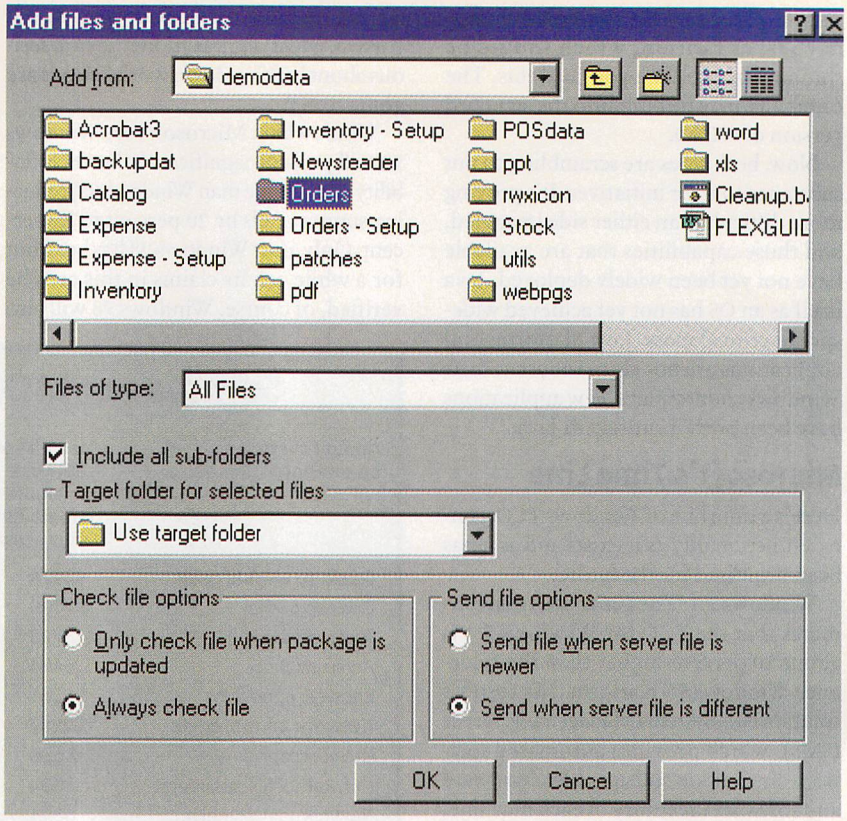
Intel is also doing what it can to provide a solid basis for management in Intel hardware. The umbrella term for its manageability efforts is Wired for Management (WfM), introduced in 1996.

WfM Baseline provides a minimum expected set of management capabilities for PC designers and management application vendors. In an ideal WfM world, customers can manage PCs from multiple vendors using their favorite set of management applications and tools. In addition, over time, developers can focus on adding value to their management applications rather than supporting redundant standards.

WfM Baseline 1.1a (the version available in PCs from manufacturers such as Compaq, Dell, Hewlett-Packard, and IBM) includes a remote wake-up feature—a chip on a network interface card (NIC) that lets the card continuously monitor the network and power up the computer when it sees a predefined packet or series of packets. AMD defined a packet (the magic packet) that constitutes the wake-up call. Intel adopted this as the de facto standard for remote wake-up. Where appropriate, however, manufacturers can define their own wake-up signals.

To address the problem of performing desktop system or BIOS updates before the OS or network drivers are loaded, Intel defined a Preboot Execution Environment (PXE) specification, in which the desktop machine uses the network as a standard boot device.

You can also use this mechanism to do a service boot, which interrupts the boot process before the OS loads, to make it easier to update the OS, BIOS, or drivers. When the PC comes up, a PXE agent executes, the PC gets an IP address from a DHCP server, and then uses the BOOTP protocol to look for a PXE server that it can boot from.




**Sterling Commerce's RemoteWare provides options for keeping files up to date on a mobile client such as a laptop.**

The PXE client is firmware, closely associated with the LAN hardware. If the LAN hardware is on the motherboard, the PXE client is typically implemented in the BIOS. If there is a LAN card, the PXE client is implemented as a boot PROM on the LAN card.

Programs, including those in the PXE environment, require system configuration and diagnostic information. Thus, Intel provides a System Management BIOS (SMBIOS), a chip that makes the necessary information available via BIOS calls that are available both via the OS and in the preboot environment.

Some problems, such as overheating, a failed fan, or tampering, can be detected only with special sensors, so WfM defines interfaces for these.

In an upcoming version of WfM Baseline, Intel will define how designers can build managed systems that don't have a locally installed OS, such as Windows terminals. Intel has also described interfaces for hot-swappable peripherals, which you can remove or attach without powering down the system.

## Desktop Management Task Force

WfM Baseline specifies the use of DMI, developed by the Desktop Management Task Force (DMTF), to which Intel belongs. DMI defines both the structure of Management Information Format (MIF) files, which contain management information for such components as processors, motherboards, and keyboards, as well as APIs for accessing that information.

A large number of management applications support DMI. Enterprise management systems that can access DMI information include HP OpenView, IBM NetView, Computer Associates' Unicenter: The Next Generation (TNG), and Tivoli Systems' Tivoli Management Environment (TME).

Other products that can access DMI information include Intel's LANdesk Management Suite and LANdesk Client Manager, Platinum Technology's LANdesk Configuration Manager, Network Associates' Zero Administration Client (ZAC)

Suite, Asset Software International's AssetPRO, Seagate's WinLAND, and Tally Systems' NetCensus.

DMI 1.0 described only a local "service layer" for accessing information in MIF files. With DMI 2.0, released in October 1997, there are two ways of accessing information over the network.

First, there is the standard DMI procedural interface for industry-standard remote procedure calls (RPCs) as defined in the Distributed Computing Environment (DCE), Open Network Computing (ONC), and Transport Independent (TI) RPC. The DCE version is used primarily by IBM and Microsoft, the ONC version by Sun Microsystems, and the TI version by Novell.

Second, DMI 2.0 describes mapping conventions between SNMP Management Information Bases (MIBs) and DMI MIFs. SNMP is used primarily by enterprise management consoles such as HP OpenView. Few desktop machines are managed via SNMP, but that may change when the DMI-to-SNMP mapper makes DMI management information visible as a MIB, says Steve Tolopka, director of Intel's managed platform lab, which focuses on WfM.

Traditionally, DMI focused on hardware. In late 1997, however, this changed as the DMTF approved a cost-of-ownership (COO) MIF. The COO MIF will store data such as purchase cost; reference number or waybill number of the purchase order; date of purchase; cost center; whether the item is owned, leased, or rented; who the corporate owner is; insurance information; and third-party support information.

Having this information easily available can help lower your costs. For instance, if a machine is leased but the technical-support department doesn't realize this, the technical-support people may spend time and money repairing a machine that could simply be swapped out with the leasing company.

Although DMI was designed to be both OS- and protocol-independent, historically it has been almost exclusively a Wintel standard. Currently, SNMP is the main link between DMI and non-Wintel environments. A DMI service provider for NetWare is available on Intel's Managed PC Web site, and service providers for some Unix-based systems are expected shortly, says Tolopka.

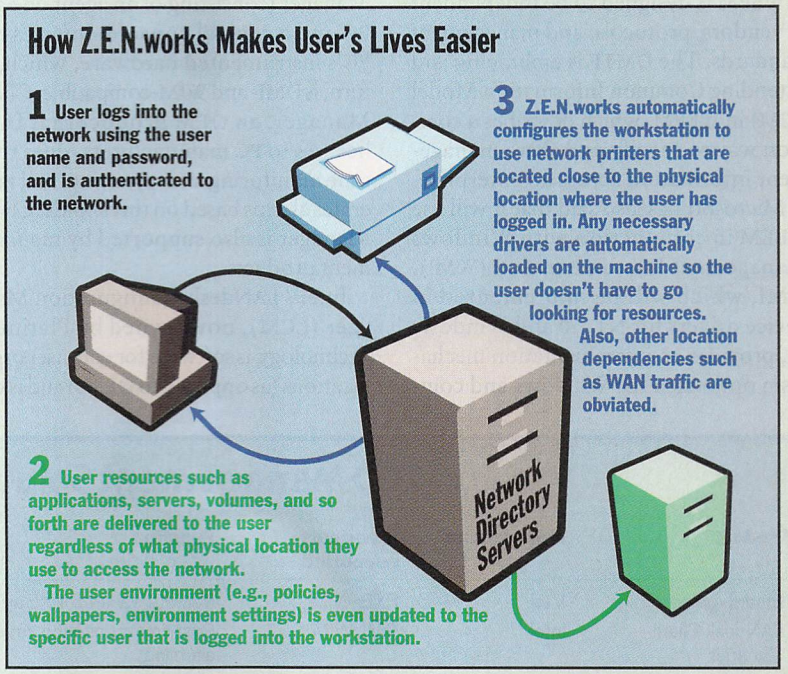
Intel has worked with Tivoli Systems to create a multiplatform management API

## Z.E.N.works Does ZAW One Better

In the second quarter, Novell introduced Zero Effort Networks (Z.E.N.works), a product that leverages Novell Directory Services (NDS) to provide ZAW-like (Zero Administration for Windows) functionality in a more centrally manageable framework. Z.E.N.works stores the following types of information in NDS: which applications and printers a person can access, where a person should go for technical support, the look and feel of the workstation (e.g., background, screen saver), who can remotely access the workstation, workstation hardware inventory, and workstation policies.

Z.E.N.works combines three products: Novell Application Launcher (NAL) 2.50, which automates application distribution and repair; Novell Workstation Manager (WM) 1.10, which ensures that a user always has the same interface no matter where he or she logs in; and a previously unreleased remote-access product, the Desktop Maintenance component

### How Z.E.N.works Makes User's Lives Easier




**Introduced this spring, Z.E.N.works leverages existing and new Novell Directory Services software to simplify desktop management.**

of Z.E.N.works, providing secure remote control.

In many ways, what Z.E.N.works does is to take ZAW and put it in an NDS framework. "They've done a good job of getting everything that Microsoft enables in terms of policies and environmental settings," says Jamie Lewis, president of the Burton Group consultancy (Salt Lake City, UT). Z.E.N.works already supports Zero Administration Kit (ZAK) policies, and when Windows NT 5.0 comes out, Novell will fold the new capabilities of IntelliMirror and Active Directory into Z.E.N.works as well, says Samm DiStasio, Z.E.N.works product manager.

The most important difference between Microsoft solutions and Z.E.N.works is Z.E.N.works' reliance on NDS. That gives you the benefits of a mature, enterprise-capable global directory, now. If you wait for Active Directory, you won't even have a first-generation product until mid-1999. On the downside, Z.E.N.works does not work for organizations with an "NT-only" strategy. You need at least one NetWare or Unix server to run NDS. (An NT-only version of NDS for NT will be available later this year, says DiStasio.)

The GartnerGroup has not done a total-cost-of-ownership (TCO) analysis on Z.E.N.works. Based on experience with NAL and WM, as well as beta testing of Z.E.N.works, savings may be in the 25 percent to 35 percent range, estimates Scott Webster, senior network analyst with Canadian Occidental Petroleum. "It will have a significant impact," says Webster. Canadian Occidental Petroleum runs NetWare 4.11 in 40 locations, with about 2500 users, most on Windows NT Workstation and a small Windows 95 population.

based on Tivoli's open application management specification, and partnered at last fall's Comdex with Computer Associates on its Managed PC Initiative.

## Web-Based Enterprise Management

Web-Based Enterprise Management (WBEM) is a coming standard to encompass DMI and non-DMI systems. WBEM is being developed by an industry consortium. It defines schemata, interfaces, and protocols for managing systems, networks, and users via Internet technology.

WBEM is designed to be independent of vendors, protocols, and management standards. The DMTF is embracing and extending Common Information Model (CIM) in WBEM, which describes a common way to specify and share management information across an enterprise.

Microsoft has also said that it will use WBEM in conjunction with Windows Management Instrumentation (WMI). WMI, which will be implemented in device drivers for NT 5.0 and Windows 98, provides an instrumentation mechanism optimized for Windows and compatible with DMI and SNMP. For more information on WBEM, see "Commanding the Enterprise" (December 1997 BYTE).

## Management Applications

Standards such as WfM, DMI, WBEM, and CIM bring organizations a step closer to reducing the TCO. But they're still only infrastructure. Management applications are where the rubber meets the road. Intel has a line of software products that incarnate the standards it has backed.

For instance, Intel's LANdesk Client Manager (consisting of an agent on each PC and a central console) queries the PC's instrumented hardware, which, in turn, is DMI- and WfM-compatible. Client Manager, an OEM product that Intel licenses to PC manufacturers, does real-time monitoring and reporting, and generates alarms based on thresholds. Client Manager is also supported by management products.

Intel's LANdesk Configuration Manager (LCM), now owned by Platinum Technology, is software for end-user organizations (as opposed to OEMs) and is designed primarily to automatically install software on networked PCs. It is a PXE server, too, so it can install the OS, drivers, and other low-level software, in addition to applications.

LCM can install different applications and desktop configurations, depending on the network user ID, company name, domain, or workgroup information. This eliminates the need for technicians to come back later and customize systems for different individuals or groups. LCM supports WfM and DMI.

A product that's focused more on ongoing management is On Technology's On Command Comprehensive Client Manager (CCM). It keeps PCs in the desired configuration by doing initial installations and upgrades, and is also designed for ongoing maintenance of desktops.

## Management on the Move

Both LCM and On Command CCM assume a permanently connected PC on a high-speed network. RemoteWare (formerly from XcelleNet, but acquired by Sterling Commerce in April) is a solution designed for mobile computers.

*continued*

### TCO Management Solutions

| Product | Manufacturer | Standards supported | Function | Comments |
|---|---|---|---|---|
| EtherExpress | Intel | PXE, WfM | Remote wake-up, PXE agent. | LAN card with LSA on a boot PROM. |
| LANdesk Client Manager | Intel | DMI, WfM | Real-time monitoring, reporting, alarming. | OEM software (sold primarily to PC manufacturers). |
| LANdesk Service Agent | Intel | PXE (part of WfM) | PXE agent. | Firmware. |
| LANdesk Configuration Manager (LCM) | Platinum Technology | PXE, DMI, WfM | Automatically install software (OS, drivers, apps), upgrade BIOS. PXE server. One-shot installation or upgrade, not ongoing repair. | Now a software-only product. (Used to require special hardware.) Still more expensive than LANdesk Client Manager. |
| On Command Comprehensive Client Manager (CCM) | On Technology | DMI, PXE, WfM | Install/uninstall software (OS, drivers, apps), upgrade BIOS. PXE server and ongoing repair. Every desktop has a "defined environment" that can be remotely restored at any time. | Software. |
| PictureTaker | LANovation | Coexists with DMI and WfM | Install/uninstall software (OS, drivers, apps), repair configurations. Troubleshooting. No BIOS now. | Software. Can be used stand-alone, but it's typically used to customize, update, troubleshoot after using disk-imaging software such as Ghost. |
| RemoteWare | Sterling Commerce | DMI, WfM | Manage mobile and remote desktops. | Software. |
| Systems Management Server | Microsoft | DMI, WfM | Install. | Software applications; also automate upgrades from Windows 95 to NT. |
| Zero Administration Kit (ZAK) | Microsoft | DMI, WfM | Automate setup of desktop clients, monitor hardware/software installation, let administrator remotely set user policy. | Free software and documentation. |



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RemoteWare is based on a "queued-event" architecture, in which tasks are queued at the server until the user connects. It is optimized for low-speed lines. It compresses data and implements byte-level differencing, which transfers only the changed parts of an updated file. It also optimizes for unreliable lines. For instance, if the connection drops in the middle of a file transfer, "check point restart" enables RemoteWare to pick up where it left off, rather than retransmitting the whole file.

RemoteWare can also automate events to occur after sessions complete. If you want to automtically install updated copies of Excel, RemoteWare will download the files, drop the line, and then install the software.

From interviews with 15 RemoteWare users, International Data determined that a large company could save $7210 per user per year over a five-year period, with an investment of only $884 per user per year.

## Do You Really Want to Reduce the TCO?

Realistically, centralized automation tends to become increasingly unwieldy and unreliable as desktops get more heterogeneous. Thus, a high degree of standardization tends to go hand in hand with most TCO approaches. Homogenization of desktops may be politically untenable. In addition, homogenization may be unsound from a business perspective, if it limits users' abilities to innovate.

Many organizations that started focusing on their TCO a year or two ago are backtracking now, notes Richard Villars, director of network software research for International Data. These organizations have discovered that lowering their TCO isn't necessarily an overall benefit.

Significantly reducing the TCO, Villars adds, usually requires backing at the corporate executive level, and a successful resolution of the conflict between the desire to control desktops centrally and the desire to give business units a free rein to make more money. B

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*Michael Hurwicz is a freelance writer and consultant based in Brooklyn, NY. You can reach him at* **mhurwicz@attmail.com.** *You can see some other articles of his at* **http://www.durrassociates.com.**

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# DSL's DEVILISH Details

*Think DSL Lite is the only thing anyone needs, that it'll be under your Christmas tree, and that your neighbor will have the same bandwidth as you? Think again.*

*By Scott Mace*

As if anyone doubted that the 1990s gold rush is made out of ordinary copper phone lines, a huge alliance set itself an ambitious goal last January: to deliver, by Christmas, a universally accepted Asymmetric Digital Subscriber Line (ADSL) standard, adopted by modem makers, telephone companies, and software houses. The first demonstrations of such equipment were expected to take place at the Supercomm show in early June.

It's a good idea. Without a broad, deployable standard, ADSL will remain a fractured technology, offered exclusively through telephone companies offering incompatible equipment at high prices. With a universal cable modem standard on the horizon, the telephone companies would lose their chance to become the broadband data-access provider of choice. But everyone agrees that a standard ADSL box, at mass-market prices, will be voraciously consumed by people demanding faster Internet access.

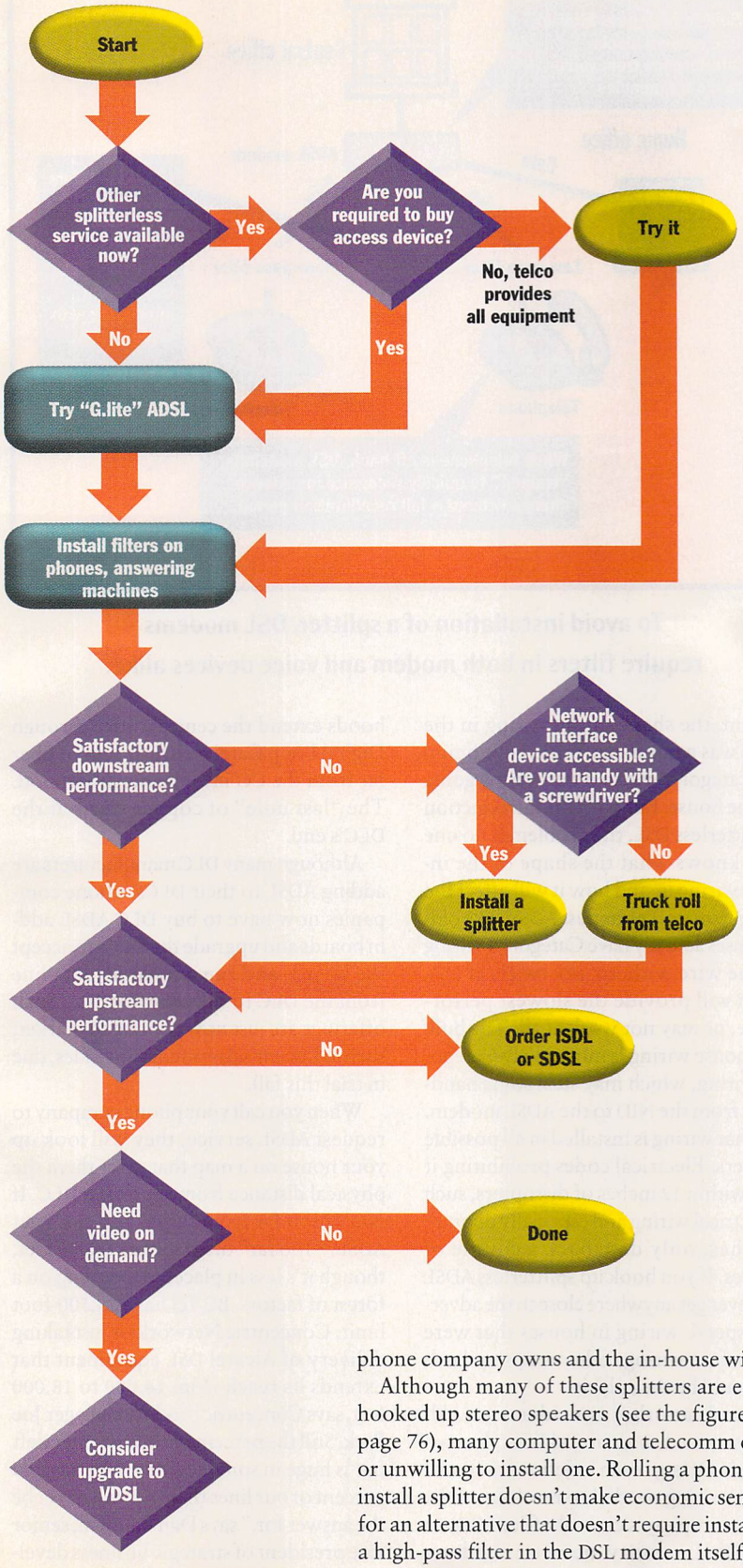
And yet, the Universal ADSL Working Group (UAWG)'s so-called G.lite standard, also known as DSL Lite, is far from the panacea it's portrayed as in the popular press. True, it does provide, for the first time, a standard way everyone can agree upon to build equipment that does not require a telephone company truck to roll every time someone wants to install ADSL service. That's the kind of historic leap that Internet bandwidth-starved consumers have been promised for the past two years.

But, G.lite still faces hurdles:

- While a preliminary UAWG standard may be out by the time you read this, the International Telecommunications Union (ITU) has to start blessing the standard for it to truly be accepted by telephone companies. That's not expected until this October, or possibly next March. Any market trials or rollouts of G.lite before then are using prestandard implementations that may not interoperate, although the UAWG is conducting its own prestandard interoperability tests.
- While equipment may be available by Christmas, the lack of a standard will almost certainly keep it out of computer stores. Some say that only when G.lite modems are on store shelves next to today's 56-Kbps modems (or built into tomorrow's 56-Kbps modems as an extra feature) will ADSL achieve critical mass. Before then, it'll be the marketing of phone companies that gets G.lite into homes and offices.
- Competing technologies are still lurking, and they're not waiting for the G.lite approach to stumble. They could fracture the phone network in a permanent way, or raise costs as equipment providers have to support multiple standards. Technologies such as Nortel's EtherLoop and Paradyne's MVL are seizing niche opportunities in places where the need for ADSL today overwhelms the need to wait for a standard implementation. For instance, US West is engaged in a massive deployment of an incompatible splitterless ADSL flavor using modems from Netspeed, which in March became a subsidiary of networking powerhouse Cisco. Dell Computer this year will begin building PCs to order with these modems.
- Service providers are facing a maddening range of customer expectations, from the first-time PC user who wants an appliance as simple as a TV set to sophisticated PC users (such as BYTE readers) who will wonder why their bandwidth is slower than their neighbor's, across the street.
- Given the often still-unknown cost of removing service-crippling bridge taps and loading coils in the copper wire infrastructure, no one is sure how much fast Internet access should cost, and how phone companies and ISPs can afford the "always on" service which is part of the broadband future.

Your decision is simpler. When ADSL comes to your town—and in many cases, it's already there (at least in trial rollouts)—should you go for it, or wait? If you have a choice of DSLs, how do you decide?

## So, You Want Faster Internet Access




The decision's an important one here in mid-1998 because ADSL is rolling out on an unprecedented scale, even though all the services are pre-G.lite. There are new ADSL chip sets already shipping, such as Alcatel's DynaMiTe chip set, newcomer PairGain's Falcon DMT chip set, recently licensed by Rockwell, and Motorola's CopperGold. These chip sets in turn are allowing second-generation central office multiplexers with lower power consumption, less crosstalk, and higher port density than their predecessors. That's driving deployments. In June, US West was scheduled to complete a 40-city rollout based on Cisco/Netspeed DSL modems, and in May it announced that Dell would build systems to order incorporating those modems. In April, GTE Network Services announced rollouts this summer across 16 states from California to Pennsylvania. Outside the U.S., major deployments are under way in Singapore and parts of Canada (see table, page 75).

Meanwhile, let's delve into DSL's devilish details, circa mid-1998.

### DSL on the Lite Side

Until very recently, ADSL required a "splitter" be installed at the network interface device (NID), the box typically on the outside of your house where the four-wire twisted pair enters the house. These splitters essentially consist of a high-pass filter and a low-pass filter to isolate the frequencies carrying voice from the higher frequencies carrying data, sending the voice signal down the existing wire pair, and the data signal down a second, usually newly installed wire pair to the DSL modem. The NID marks the boundary between the wiring the phone company owns and the in-house wiring, which you own.

Although many of these splitters are easily installed by anyone who's ever hooked up stereo speakers (see the figure "Splitter Installation Demystified," page 76), many computer and telecomm companies say consumers are unable or unwilling to install one. Rolling a phone company truck to each residence to install a splitter doesn't make economic sense; so last year the search commenced for an alternative that doesn't require installation of a splitter. The solution: Put a high-pass filter in the DSL modem itself, avoiding the bottom 4 KHz used by

voice traffic, and put low-pass filters on each voice device in the house, to reject signals above 10 Khz. It was what DSL needed: Rockwell, Aware, and Netspeed got there first.

The Rockwell and Aware approaches dictated a throttled-back ADSL, typically with 1.5 Mbps downstream and 384 Kbps upstream—a far cry from the 8 Mbps ADSL was supposed to deliver downstream, but still plenty faster than today's 56-Kbps modems. It's fast enough for now, while still providing the "always on" appeal of ADSL, sharing a phone line with POTS voice service. The Netspeed approach leaves open the possibility of sharing two or more DSL lines with the same modem, effectively reducing bandwidth that way. Throttling back has been a hit: "If I had to choose, I'd choose continuous connection" over high speed, says Craig Mundie, senior vice president of Microsoft's consumer platforms division.

Each phone and answering machine needs its own low-pass filters—small plugs that look just like the RJ-11 extenders you can buy at Radio Shack. These filters, a few of which will be included in the box with many splitterless DSL modems, prevent feedback that could degrade bandwidth and introduce audible noise on the phone line.

Neither Rockwell's initial splitterless implementation, Consumer DSL (CDSL), or Cisco/Netspeed's EZ-DSL, used the Discrete Multitone (DMT) scheme approved recently by the ITU for T1.413 Issue 2, attention focused on Aware's DSL Lite, which used DMT.

Another detail going into G.lite modems is known within the UAWG as "fast retrain"—a way to recognize patterns of impedance changes when, for instance, you take your phone off the hook. Without fast retraining, G.lite modems might have to pause as much as 10 seconds while they figure out what data rate they can support, says Michael Tzannes, chief technical officer at Aware.

Expect to see trial service of G.lite from telcos such as Bell Atlantic by the end of the year, starting with very limited availability. Again, chip sets (such as Lucent's WildWire, announced in January 1998, due out in the third quarter) will drive deployments.

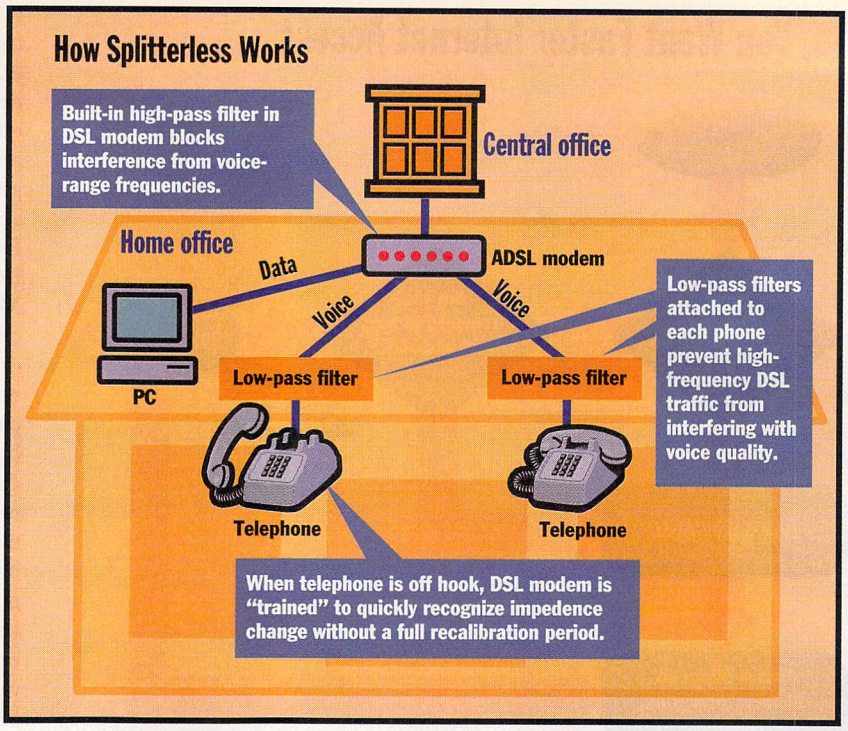
## Wiring Woes

When ADSL was going to dictate a new wire running from the NID to your ADSL modem, the shape of the wiring in the house was a nonissue: You'd have brand new Category 5 twisted-pair wiring going into the house. But with the introduction of splitterless DSL, the problem is no one quite knows what the shape of the in-house wiring is, and how it will affect the performance of splitterless ADSL. The oldest houses actually have Category 1 wiring (phone wire without any twists at all), which will provide the slowest performance, or may not work at all. The bulk of in-house wiring is more likely Category 3 wiring, which may steal some bandwidth from the NID to the ADSL modem. And that wiring is installed in all possible manners. Electrical codes prohibiting it from within 12 inches of disrupters, such as electrical wiring and especially dimmer switches, only date back a couple of decades. If you hook up splitterless ADSL and never get anywhere close to the advertised speed, wiring in houses that were built before wiring codes were standardized could be the culprit.

There's another consideration. All ADSL service has a natural limit, known as *reach*. Often, reach is defined as feet of copper wiring needed to reach from the phone company's central office (CO) to the NID. In reality, newer neighborhoods extend the central office through Digital Loop Carriers (DLC) runs of fiber far from the CO into the neighborhood. The "last mile" of copper starts at the DLC's end.

Although many DLC manufacturers are adding ADSL to their DLCs, phone companies now have to buy DLC ADSL add-in boards and upgrade the DLCs to accept the boards and run a separate data line from the DLC to the central office. Such offerings are just now coming to market, such as Lucent's AnyMedia upgrades, due in trial this fall.

When you call your phone company to request ADSL service, they will look up your house on a map that gives them the physical distance from the CO or DLC. If you're too far from these, you can't get ADSL. "Too far" often means 18,000 feet, though it's less in places, depending on a forest of factors. BC Tel has a 13,500-foot limit; Concentric Networks is just taking delivery of Alcatel DSL equipment that extends its reach from 14,000 to 18,000 feet, says Concentric product manager Joe Peck. Still the percentage of customers left out is huge in some regions. "We have 40 percent of our lines that DSL will never be the answer for," says Dan Baldwin, senior vice president of strategic business devel-




**To avoid installation of a splitter, DSL modems require filters in both modem and voice devices alike.**

## ADSL Trials and Service Deployments

Here's a sampling of currently available ADSL, either in trial stage or in full operating service. For a lengthier list, see *http://www.adsl.com/trial_matrix.html*.

| Company | Availability | Speed | Trial Date | Service Deployment |
|---|---|---|---|---|
| Ameritech | Ann Arbor and Royal Oak, MI | 1.5 Mbps down, 128 Kbps up | Concept trial: Oct. 1996 to Apr. 1997 | More cities to be added monthly starting June 1998 |
| Bell Atlantic | Northern Virginia | 1.5 Mbps down, 64 Kbps up | Market trial: ongoing, with 325 customers | Rollout in mid-1998 of RADSL service; up to 7 Mbps down |
| BellSouth | Birmingham, AL | 640 Kbps | Market trial: Oct. 1997 to May 1998 | Wide-scale deployment in 1998, starting with top six metropolitan areas |
| Concentric Network Corp. | 10 cities in Northern California | 1.5 Mbps down, 384 Kbps up; or 384 Kbps in both directions | Launched in November 1997 | |
| Covad Communications Inc. | San Francisco Bay Area and Silicon Valley, CA | 384 Kbps in both directions; 1.1 Mbps in both directions | Launched ADSL service in Dec. 1997 | Available to 700,000 homes; plans to offer ADSL to 5 million more in Boston, New York, Washington, D.C., Los Angeles, and Seattle by March 1999 |
| GTE Communications Corp. | Redmond, WA, etc. | 256 Kbps down, 64 Kbps up; 384 Kbps or 768 Kbps in both directions | | Launching in 16 states this summer |
| SBC Communications | San Francisco Bay Area and Austin, TX | Business: 1.5 Mbps down, 384 Kbps up. Consumer: 384 Kbps in both directions | July/August 1996 – ongoing | |
| US West | 40 cities by summer 1998 | Up to 1 – 4 Mbps down, 1 Mbps up | | 5 million customers accessible by June 1998 throughout US West territory |
| BC Tel | Greater Vancouver, Victoria, Kelowna, Kamloops, Prince George, B.C. | 1.5 – 4 Mbps down, 160 – 640 Kbps up | Tech and market trials 1996–1997 | MultiMedia Gateway service launched January 1998 |
| Bell Canada | Ottawa/Hull and Quebec City areas | 2.2 Mbps down, 1 Mbps up | Sept. 1996 – ongoing | October 1997 rollout in Ottawa/Hull & Quebec City areas; will offer to business in 1998 and expand to Montreal and Toronto markets |
| Manitoba Telephone System | Winnipeg, Manitoba | 1.5 Mbps down, 64 Kbps up | Nov. 1996 – ongoing | December 1997; by end of 1998, 90% of Winnipeg customers will have access |
| Maritime Telephone & Telegraph | Halifax, Nova Scotia | Up to 7 Mbps down | Apr. 1997 – ongoing | Nov. 1997 limited deployment |
| QuebecTel | Quebec | 640 Kbps – 2.2 Mbps down, 272 Kbps – 1 Mbps up | | Sept. 1997 |
| SaskTel | Regina, Saskatoon, and Prince Albert, Saskatchewan | 1.5 Mbps down, 64 Kbps up | Regina & Saskatoon launched Nov. 1996; | Prince Albert added Jan. 1998; 1000 users |
| Helsinki Telephone Co. | Helsinki, Finland | 2 Mbps down, 9.6 Kbps up | Aug. 1995 – Mar. 1996 | Feb. 1997 |
| Swisscom | Grenchen, Switzerland | 2 Mbps down, 9.6 Kbps up | Sept. 1995 – ongoing | Market trials to begin in Zurich, Geneva, and three other cities in 1998 |
| Telecom Italia | Turin, Italy | 640 Kbps – 2.24 Mbps down, 272 Kbps – 1 Mbps up | Early 1997 | |
| Korea Telecom | Six Korean cities including Pusan | 4 Mbps down, 128 Kbps up | Aug. 1996 | Early 1998 |
| Singapore Telecom | Singapore | 5.5 Mbps down, 168 Kbps up | Commercial trial: June1997 – ongoing | 7000 lines in operation; island – wide rollout by end of 1998 |

opment and marketing at SaskTel in Saskatchewan. In Europe, where loops are usually less than a mile, the shortfall won't be as bad.

Since copper wires don't run in straight lines from their head-ends, the phone company must still check its wiring-plant records to determine if the wiring itself exceeds the maximum limit. Even within the maximum distances, "Those on longer loops will have to accept a lower bit rate," says Jeff Waldhuter, executive director of Bell Atlantic's technical broadband organization.

But there's one more catch. Phone companies don't know how long your in-house wiring is, and it must be considered to determine total distance. If your wiring snakes all over the house, that might be enough to exceed the limit. Some DSL equipment makers are concerned about this problem and some aren't.

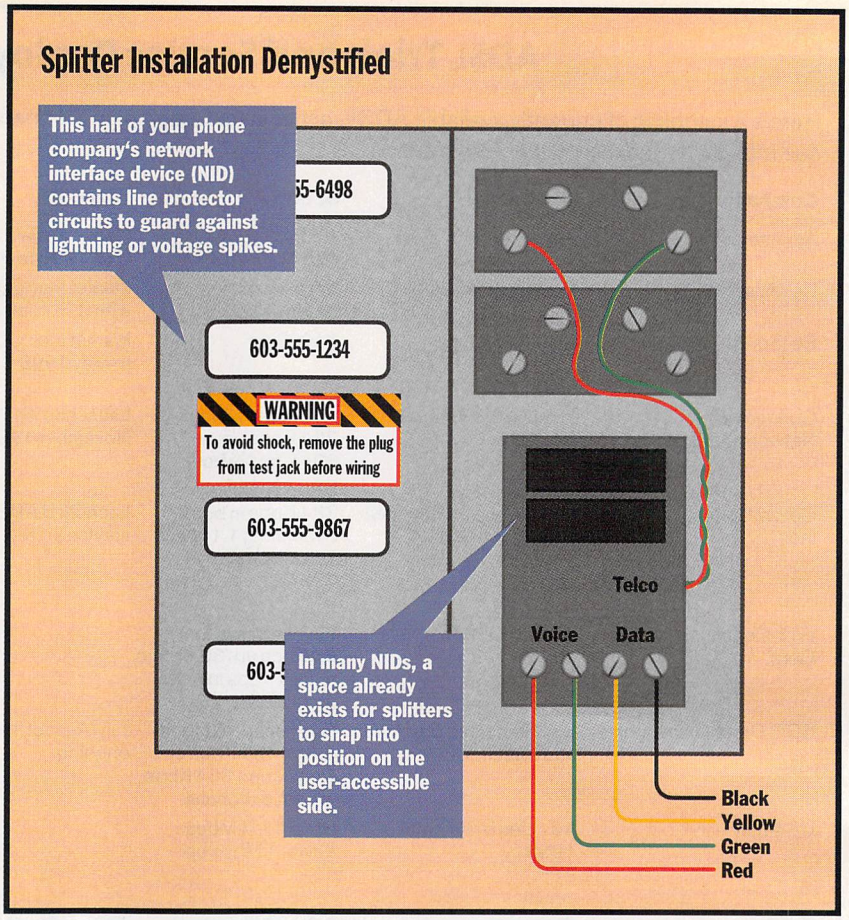
As if that isn't bad enough, some vendors predict that when customers complain to their local public utilities commission, the PUC could order the phone company to provide "equal" services, for instance to customers on different sides of the same street who may have different lengths of copper run. To avoid a bruising political fight, telcos might prefer to offer only the lowest possible data rate.

Just how many customers will be afflicted by distance and in-house wiring woes, no one knows. The UAWG is currently conducting the first-ever systematic survey of the U.S.'s in-house wiring in order to find out.

Multiunit dwellers have both opportunity and challenges of their own. NIDs are often quite different than those in single-family homes, and landlords control their configuration. Progressive landlords are already putting in entire DSL access multiplexers in building basements, with T-1 or T-3 lines out the back end; laggard landlords may never permit installation of DSL equipment, such as splitters. In such cases, cable modems have an almost certain advantage, since they already have the coax in place. "Whatever people install first, they're going to keep for a long time," says David Briere, president of TeleChoice, a market research firm.

## DSL du Jour

Someone forgot to tell the industry to stop innovating while G.lite gets off the ground. Paradyne (with MVL) and Nortel (with EtherLoop) in particular are keying in on some of G.lite's shortcomings.




**Splitterless DSL modems require high-pass filters, plus low-pass filters adjacent to phones and answering machines.**

Paradyne's MVL, which shipped in April, uses quadrature amplitude modulation (QAM) instead of DMT. (CDSL uses QAM as well). There's every indication that the forthcoming G.lite standard will also be based upon DMT. "It's almost a foregone conclusion," says Sassan Babaie, vice president of marketing at Pulsecom, a DSL equipment provider. Although it requires more power and generates harmonics that are difficult to echo-cancel, DMT is better at adapting to impairments in the frequency domain than QAM or carrierless amplitude and phase modulation (CAP).

Still, MVL "has a lot going for it," says John Hunter, broadband analyst at TeleChoice. MVL lets users connect up to eight computers or peripherals in their house using MVL modems, using the house's phone wiring as a LAN. The feature recognizes how quickly consumers will want to hook up multiple computers to DSL (see "Share and Share Alike," page 77). MVL can also run up to 24,000 feet, longer than DMT-based schemes, though aggregate bandwidth is limited to 768Kbps—linking two points, that's only 384 Kbps per host.

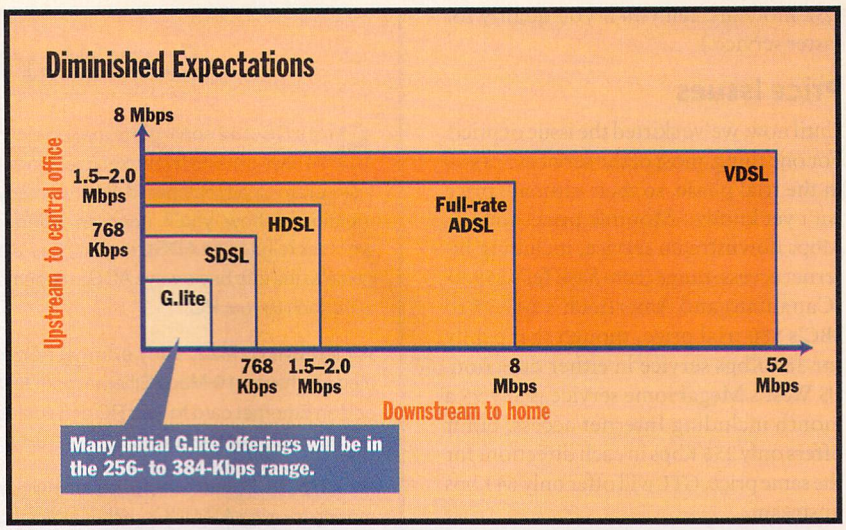
Nortel's EtherLoop, introduced in March by its Elastic Networks division, treats groups of telephone wires as shared media—hence the Ethernet allusion. "You have to treat all 25 or 50 pairs in the group as having interactions with one another," says senior marketing manager Scott Ryan. When these groups just carry voice at low frequencies, the crosstalk between pairs is manageable, but DSL's high frequencies boost power to levels that bedevil engineers trying to minimize crosstalk and thus maximize throughput. Rate-adaptive DSL (RADSL) is the solution, but of course the adaptation often results in slower speeds. While ADSL is always transmitting, maybe just status nulls, to

maintain a connection, when Etherloop doesn't have anything to send, "it drops to a noninterfering [250-Kbps] speed and power level," Ryan says. Others have characterized EtherLoop as "QAM over Ethernet." It's important to note, though, that instead of using Ethernet's collision detection, EtherLoop practices collision avoidance, similar to Token Ring. That way, the whole scheme can work on an 18,000-foot line.

Of course, the bursty nature of EtherLoop may have its own crosstalk problems, and may be less conducive than normal DSL to carrying voice traffic or other quality-of-service applications, but in a world starving simply for faster Web access, and one where QoS is being grafted onto bursty packet networks, that may work itself out.

Both MVL and EtherLoop sound pretty intriguing—so why aren't they getting more attention? Simple answer: They're not the standard. Whether they're better than splitterless T1.413 ADSL or not, it doesn't really matter to incumbent telephone companies. The UAWG has made its choice of a standard, and neither MVL or EtherLoop is it. The best technology doesn't always win, no matter which one you think is best. For now, MVL and EtherLoop will thrive in niche markets. Because they consume less power, MVL and EtherLoop may also proliferate particularly where DLCs are common. MVL will also get accepted in neighborhoods where copper runs exceed 18,000 feet, and Elastic Networks is targeting hotel and other large buildings that control both ends of their copper wire. Both technologies could also prosper in apartment buildings, and if G.lite stumbles, competitive local exchange carriers (CLECs) might push them out into single-family neighborhoods as well.

There's also a reason why so many companies are targeting 384 Kbps for their introductory consumer service. Traffic can't traverse the Internet much faster (see "The 384-Kbps Ceiling," page 78). You may want to hold off on ordering faster speed than that. (If backbone speeds aren't the culprit, some service providers, such as US West, can remotely test your local loop and, if you already have one of their




**DSL equipment makers have throttled back performance to create G.lite, while at the high end they pursue digital TV markets.**

## Share and Share Alike

The availability of ADSL and cable modems comes at a time when people are buying second or third computers for the home. Telecommuters and power users alike will want ADSL routers, but will service and equipment providers give it to them?

The answer is "maybe." The demand is clearly there. Some SaskTel ADSL subscribers "are sitting there with six or seven computers in their basement," says Dan Baldwin, senior vice president of strategic business development and marketing at SaskTel.

One catch: Telephone companies just got out of the business of doing in-house wiring, around the time of the AT&T breakup. Now, few of them have the resources to go back into it, especially when it's to create a home LAN, says David Briere, president of the TeleChoice market research firm.

"The question is: How do you package the concept of networking and WAN in a way the broad base of consumers can get?" says David Dorsey, manager of technology strategy for Compaq's communication product division.

ISDN routers have been out for years, and the first wave of ADSL routers looks pretty similar. Covad's Telespeed service uses an Ascend Pipeline 50 for ISDN routing, and when customers want ADSL 384-Kbps service or better, Covad gives them a Diamond Lane ADSL router, says director of marketing Lou Pelosi.

Others who are ready with ADSL routers include Aware, 3Com, and Cayman Systems. Chip set vendors including Motorola are eyeing ADSL routers as lucrative areas. Intel recently formed a home networking division, though it hasn't announced any products yet. All these solutions are likely to leverage existing in-house phone wiring rather than require expensive new wiring.

When ordering ADSL service, be careful that the contract you sign doesn't prevent you from hooking multiple PCs to your ADSL line. Ameritech has such a restriction. Phone companies are understandably worried about the prospect of your ADSL line being in constant use from computers all over your house. But they're fighting a losing battle. "It's a losing proposition to say no" to multiple PCs, says John Girard, vice president and research director of GartnerGroup's Network Center (Stamford, CT).

Some telcos, such as US West, are openly embracing ADSL routers and will offer them as a value-added home LAN service, along with Web hosting and multiple e-mail boxes. Customers will install their own routers, though. Realistically, it will be difficult for the phone company to know if you have only one computer behind your ADSL box or not. Standards such as G.lite will propel sales of ADSL-ready routers for home LANs. You may need to trade up to a faster ADSL service in order to get the performance you want out of each device, though.

DSL modems, tell you if you qualify for faster service.)

## Price Issues

Until now, we've skirted the issue of price. For one thing, most of the services are still in the trial phase, so their ultimate price isn't yet known. Monthly prices for 1.5-Mbps downstream service, including Internet access, range from SaskTel's $59.95 (Canadian) and Ameritech's $49.95 to SBC's $80 trial price, though that's only for 384-Kbps service in either direction. US West's MegaHome service is $59.95 a month including Internet access, but it offers only 256 Kbps in each direction; for the same price, GTE will offer only 64 Kbps upstream.

Cable companies clearly influence ADSL pricing, yet phone companies won't want to offer T-1 services (which today still sell for $800 to $1,200 a month, though dropping fast) at analog modem ISP rates. Industry observers say there's little danger of that. First, T-1 (1.544Mbps) is often a guaranteed rate, while most equivalent DSL service promises only up to 1.544Mbps. In some cases the service can degrade to as little as 64Kbps. One company says that'll still be acceptable given that it's faster than 56Kbps modems. But it would be a far cry from the original ADSL hype, and it had better not cost much more.

ISPs such as BC Tel are also considering usage fees above a certain amount of bandwidth consumed, such as a gigabyte a month. Considering the strain DSL may put on their backbone service, the days of all-you-can-eat Internet access might be numbered. Or maybe not: The administrative overhead of counting those packets could quickly gobble up any extra revenue.

Another consideration: If those who cannot receive DSL band together to complain that the phone companies are subsidizing urban ADSL service with their basic rural service, watch out. It's possible to account for the costs of upgrading the phone network many different ways, and DSL service could end up being paid for by its early adopters far more than the $40 figure often bandied about. In many cases, the politics of public utility commissions might be the final arbiter.

Finally, if you have a choice to buy or lease your DSL modem, weigh the options carefully. Ameritech charges $150 for installation, but then you own the Alcatel DSL modem the company provides. Ameritech's is ATM-based, though, so think about whether you're likely to move into another service area that might be standardized on Ethernet. It may make more sense to lease the modem month to month, especially considering that a G.lite/V.90 hybrid modem could command 30–50 percent more dollars than a typical V.90 modem, according to Rick Hall, strategic planner for xDSL systems at Motorola. Longer term, ADSL modems may come with both an Ethernet and an ATM interface, which could provide you with maximum flexibility.

Also be prepared for a range of price options beyond one simple dollar figure. For instance, US West will sell simple DSL access for $40; it's up to you to pick an ISP if you opt for that. Later this year, US West customers will also be able to buy a somewhat lower-cost service that exploits patented Cisco/Netspeed technology that lets multiple DSL users share a single modem. You'll never know that your line's being shared with other users, according to Greg Gum, executive director for solution development for US West's megabit services. Others predict a momentary lag, up to 2 seconds, as the

## Four Ways to Connect

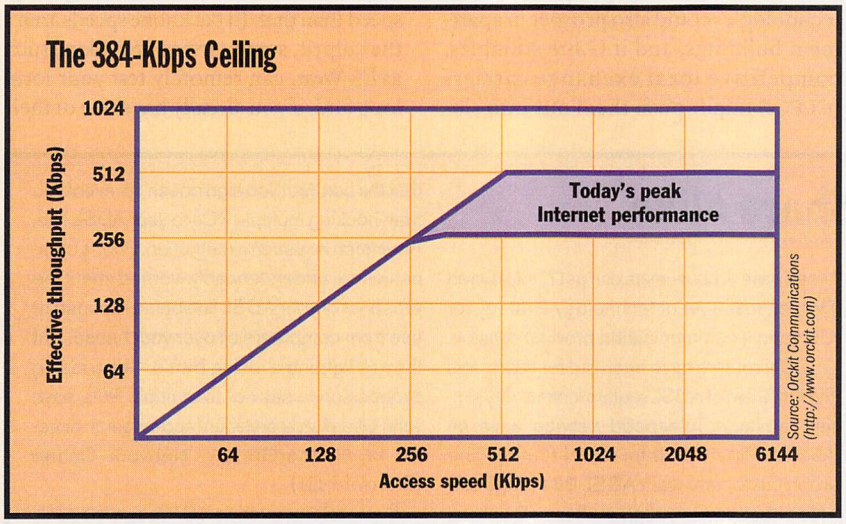
Since RS-232 serial ports are too slow, the days of using them to connect to the Internet are clearly numbered. We've already mentioned how you'll need to ponder whether to have an ADSL router. Here's a guide to the four basic ways ADSL modems will attach to your PC.

➡ **Ethernet.** Many early external ADSL modems have a 10-Mbps Ethernet port. Just add an Ethernet card to your PC and you've got the basic connection.

➡ **ATM-25.** Phone companies are quickly moving to using ATM NICs, either attaching them to a separate ADSL modem or incorporating the NIC and modem on a single plug-in card. The protocol specified by the UAWG for G.lite is PPP over ATM. Even the modems with Ethernet ports, mentioned above, are probably running PPP over ATM back to the phone company.

➡ **Universal Serial Bus.** As early as last fall Comdex, Alcatel, and Intel demonstrated a prototype USB ADSL modem. None are commercially available yet, but expect a rash of them after USB gains momentum.

➡ **On motherboards.** If G.lite chip sets get really cheap, and the service meets expectations, we could see it as a standard feature, much like infrared devices on portable computers.

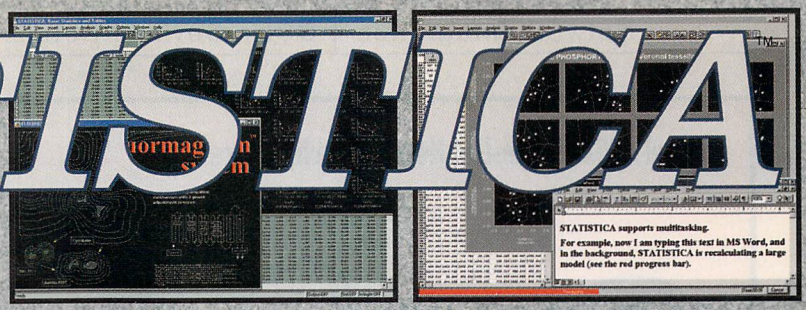


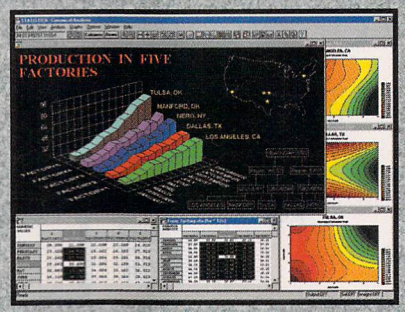

**Adding access speed beyond the average of 384 Kbps may not increase performance, due to Internet bottlenecks.**

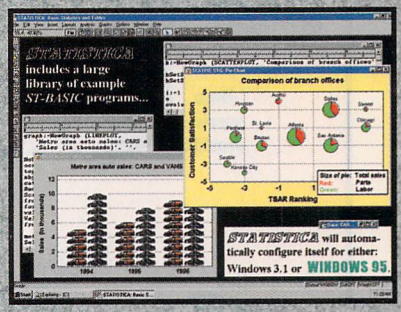


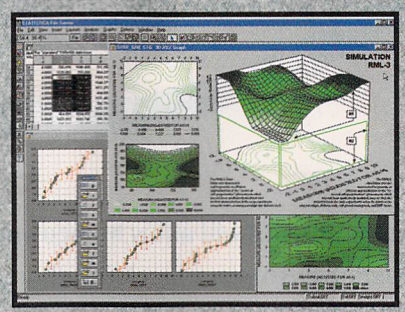
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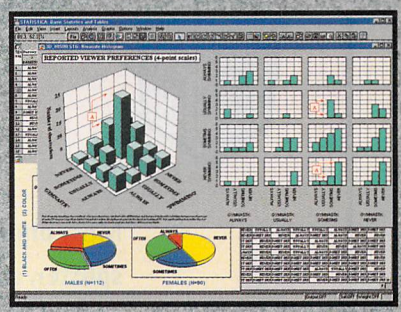
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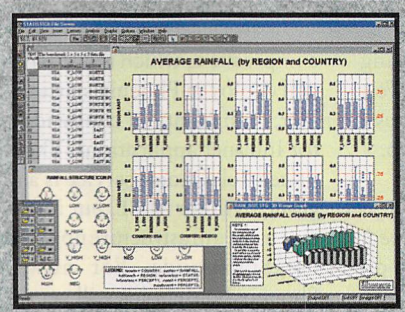


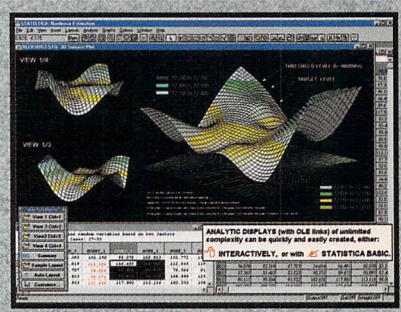



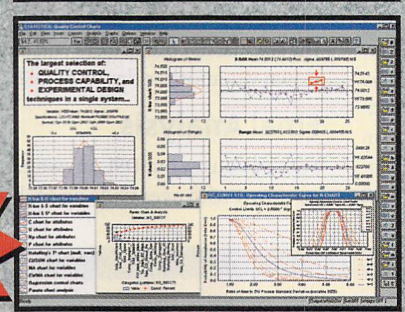



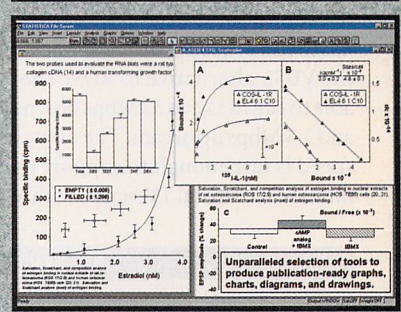



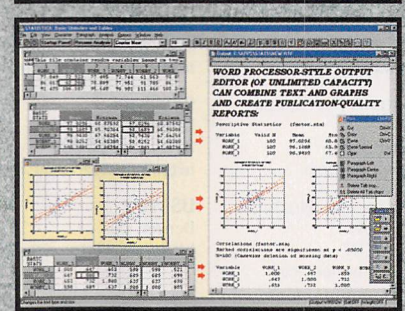



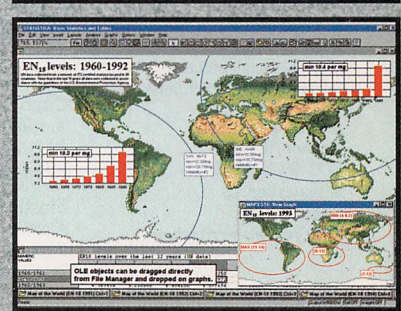




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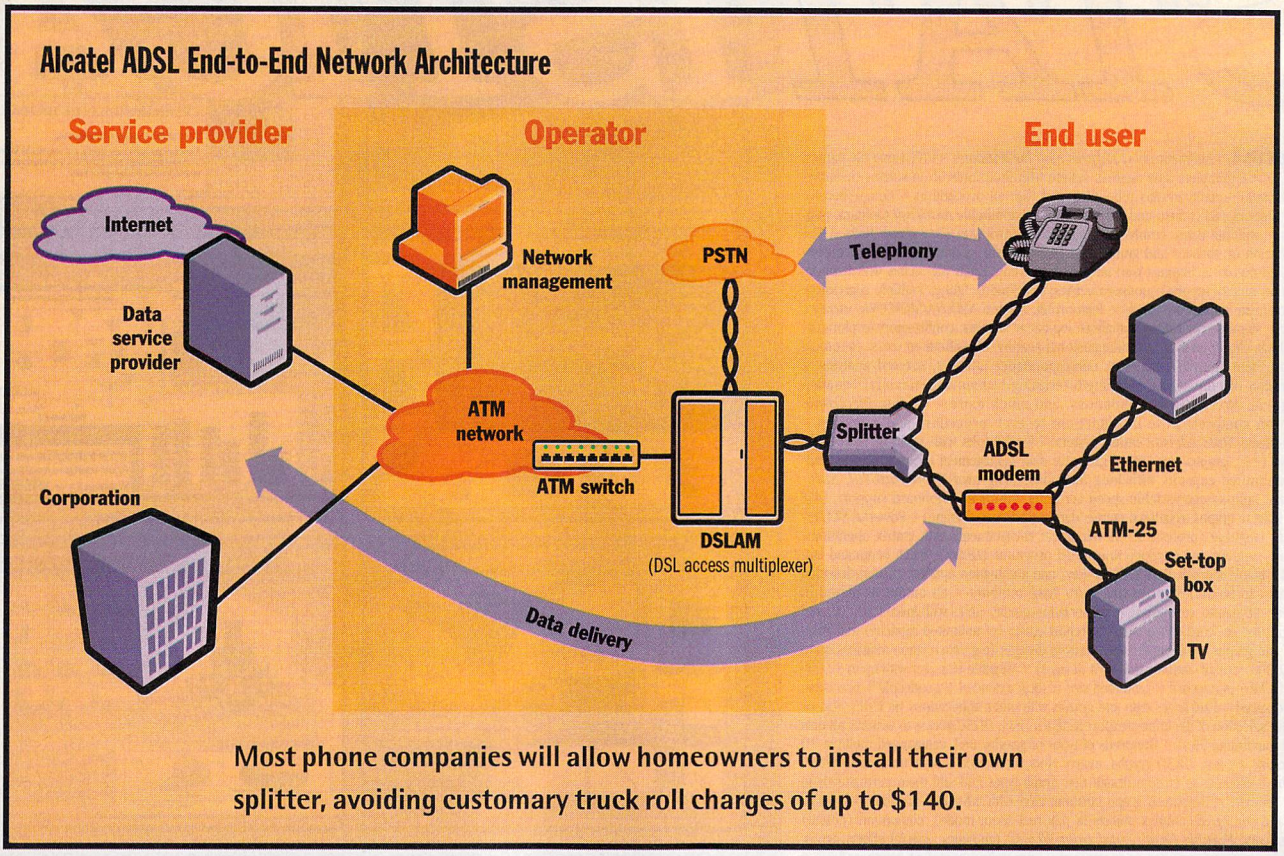

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**Most phone companies will allow homeowners to install their own splitter, avoiding customary truck roll charges of up to $140.**

Cisco modem recognizes you're using your PC again. Another planned US West service will let users have static IP addresses instead of today's dynamic IP setup.

## The Return of Video

The V in VDSL stands for *very high-speed*, but it might as well stand for video on demand, which ADSL may struggle to deliver. In some neighborhoods, copper has to run a much shorter distance. There, the VDSL alternative to ADSL should be able to run as fast as 52 Mbps downstream and 2.3 Mbps upstream. The downstream speed is fast enough to support three simultaneous digital TV signals with MPEG2 compression, which is just what US West will deploy in Phoenix starting this summer, with plenty of bandwidth left over for Internet applications. The as-yet unpriced TeleChoice service is a future upgrade path for ADSL, but it may require extensive infrastructure upgrades in most neighborhoods. For now, 400,000 Phoenix households will get their hands on today's ultimate DSL technology, and the standards committees will have to nail down yet another flavor of DSL.

## Final Analysis

Should you try out DSL anyway? Sure. But go into it with eyes wide open. Even if the technology comes "for free" on the motherboard of your next PC—which many are predicting will happen, starting with Compaq—be aware that there are still choices to consider.

Remember that, ultimately, ADSL will be bigger than PCs. Mundie recently sketched out a future Web TV that can send "a nasty piece of electronic mail to the phone company, which says 'I am ADSL ready and you're not.' At that point you have a completely targeted marketing program to go out and add that service, it will automatically upgrade to go from dial-up to ADSL." Over time, he says, fancier service could be installed with a truck roll, but initially, "it better be like plugging in their telephone today."

Meanwhile, there's some months to go before that happens. "My hunch is we're two years out from availability in the top 100 metropolitan markets," says Dick Edmiston, vice president of research and development at Earthlink Networks. Obviously, between now and then, there could be more twists and turns than you'll find in your phone wiring. B

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*Scott Mace is a senior editor at BYTE. You can reach him at* **scott.mace@byte.com.**



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# Building Web Information Systems

*Think a single interface to all your decision-support information is impossible? Think again.*

*By Colin White*

Given the increasing amount of data that exists in organizations today, providing users with the information they need for making business decisions is not a simple task. Data warehousing and corporate intranets are two key new technologies that offer potential solutions for managing these mountains of data.

This article looks at how you can use these two technologies together to distribute corporate information to business users, as well as how you can employ Web-based data-warehousing techniques to support a business-intelligence system that gives users a single interface to business information throughout an enterprise.

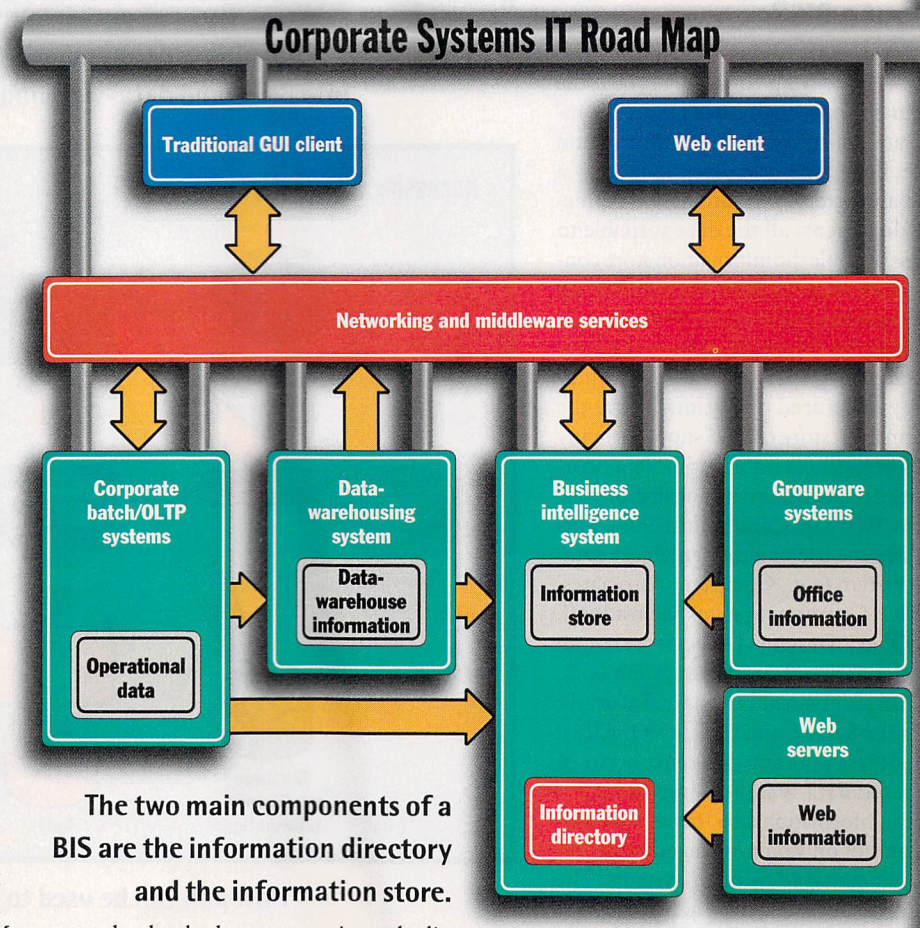
## Web-Based Data Warehousing

Data warehousing is a process that extracts data from operational databases and files and loads it into a separate information store for processing by query, reporting, on-line analytical processing (OLAP), and data-mining decision-support system (DSS) tools. The main advantage of data-warehousing systems is that they supply business users with a clean, integrated, consistent, historical perspective of corporate business information.

Early adopters of data-warehousing systems employed traditional client/server computing tools and techniques to access a warehouse information store. More recently, the deployment of corporate intranets has led to the use of Web-based clients for accessing warehouse database servers.

Making a data warehouse Web-enabled offers many benefits. For example, Web interfaces involve thin clients that have lower hardware requirements than regular desktop systems. This reduces hardware costs, improves reliability, and lowers hardware-maintenance overhead. The use of thin clients also allows organizations to take advantage of new hardware technologies, such as network computers and Windows-based terminals.

In addition, most of the software used by Web-based clients is stored on local servers and downloaded to clients as required. This approach significantly reduces the effort involved in installing and maintaining client software, such as DSS tools and database middleware. The downside of server-based software maintenance is that it requires higher server capacity and reliability, and in some cases improved network bandwidth. Web technology provides a standardized addressing environment involving universal IP-based networking and document identification via URLs.




**The two main components of a BIS are the information directory and the information store.**

Although data warehousing and Web-based client com-

puting provide significant benefits to organizations, they don't offer a complete solution to the problem of supplying users with the business information they need. The information stored in a data warehouse is usually sourced from operational databases (and, in some cases, external information providers). However, a great deal of business information is also kept in office and workgroup systems, on Web servers linked to corporate intranets and the Internet, and in paper form on people's desks. This information should also be accessible from the same Web-based client interfaces used for data warehousing. One solution to this problem is to employ data-warehousing techniques to build a business intelligence system (BIS) that provides an interface not only to information stored in data warehouses but to that stored on other systems.

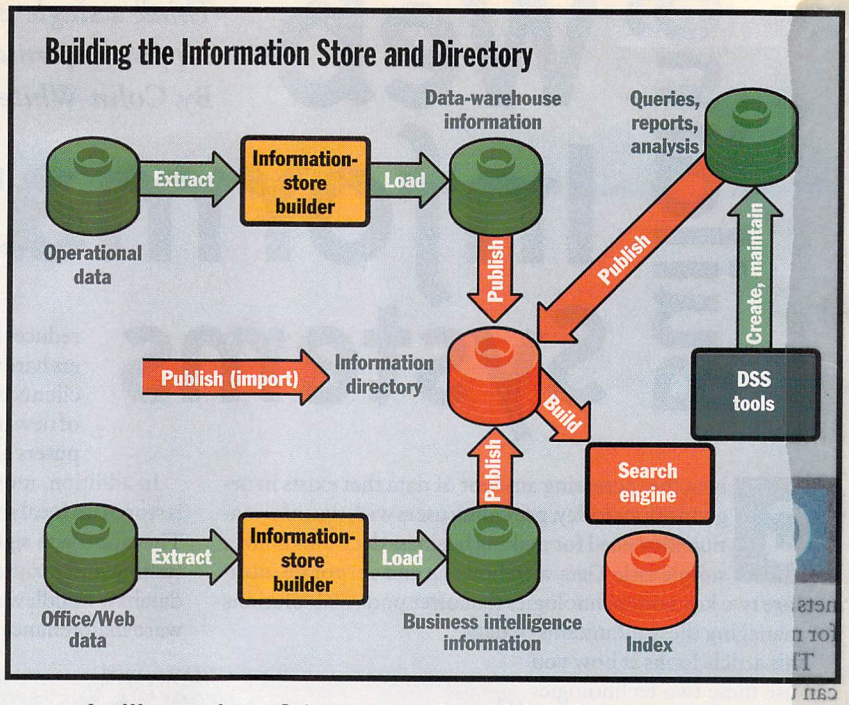
## What's Different About a BIS?

As shown in the figure "Corporate Systems IT Road Map" on page 80NA 1, the two main components of a BIS are the information directory and the information store. Both are normally managed by a database system. The information directory documents all the data available to BIS users, while the information store contains data that has been extracted from other systems and integrated into the BIS.

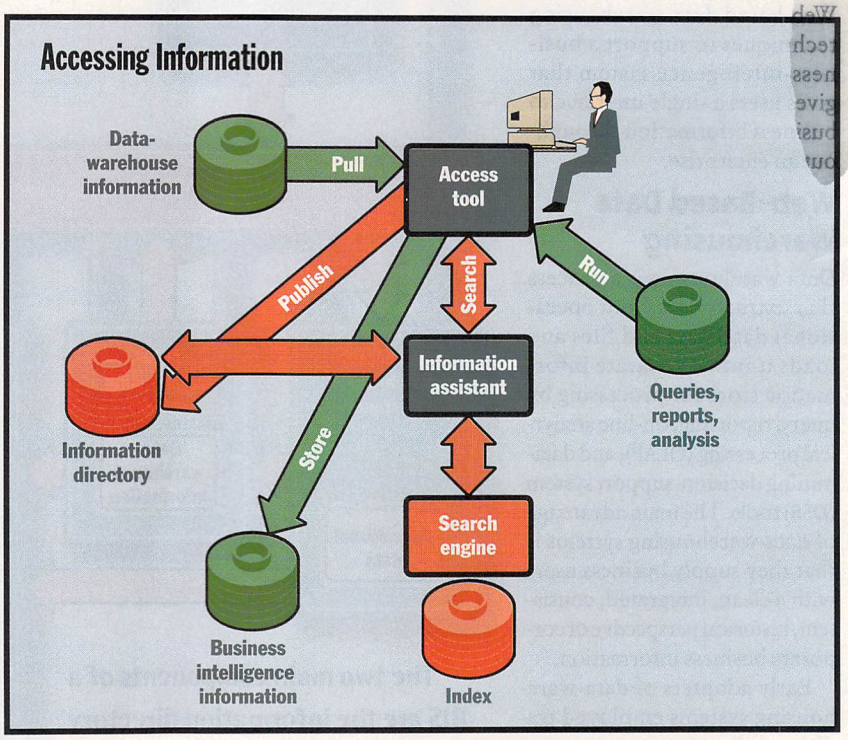
Unlike the information store of a data-warehousing system, which manages highly structured operational data, the information store of a BIS supports many types of business information (e.g., corporate data, word processing documents, charts, Web pages, and multimedia). This requires the use of either an object database system (e.g., Computer Associates' Jasmine, Gemstone Systems' Gemstone/J, and Object Designs' ObjectStore) or an object-relational database system (e.g., IBM DB2 Universal Database, Informix Dynamic Server, and Oracle's Oracle8).

Another important difference between BISes and data-warehousing systems is that the information directory of a BIS documents not only data managed by the BIS but that managed by other systems. The BIS information directory acts as the road map to all of an organization's key business data.

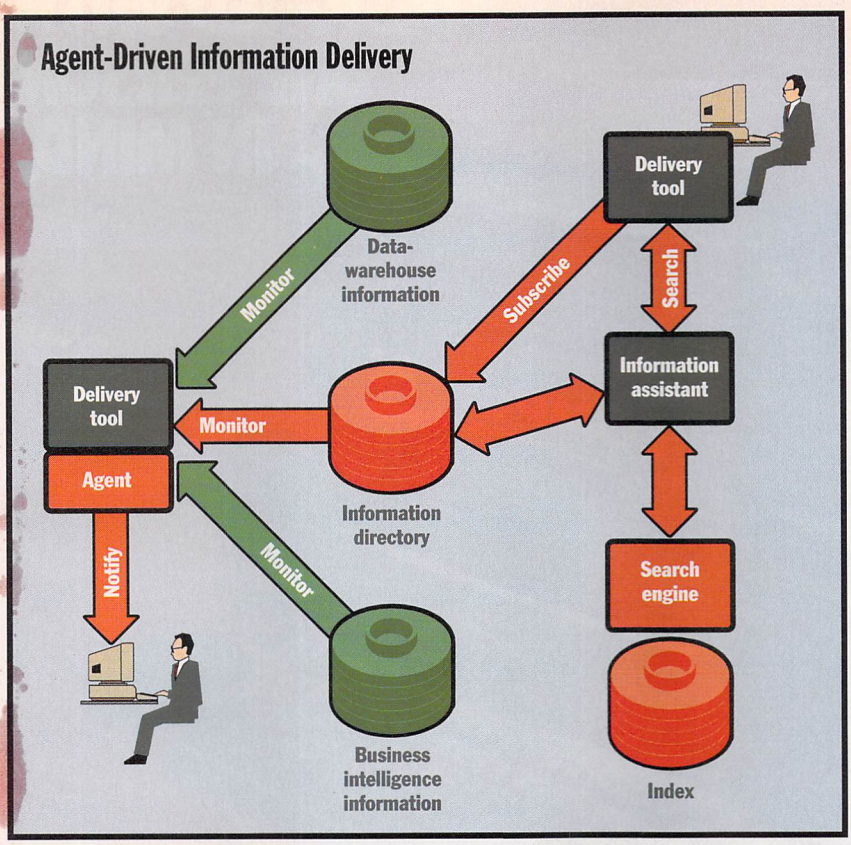
The information store of a BIS is normally managed by a database system, which provides benefits such as security, backup and recovery, scalability, integrity, serialization control, and versioning. The use of a database system also allows the information content of the BIS store to be retrieved, searched, and manipulated using a single data API and language. Information left outside of the BIS store is not as integrated and might involve the use of multiple data APIs and languages.




An illustration of the manner in which information flows into BISes and data-warehousing systems.




How pull can be used to retrieve information from a data warehouse.




**Agent-driven techniques use subscriptions that define business rules to run in an agent.**

But integrating business information into the BIS store has certain disadvantages. The cost and resources needed to install and maintain the information-store DBMS must be considered. Also, non-database APIs often cannot access the information. To solve this problem, database vendors are enhancing their products to allow certain types of information to be accessed through both the data API and regular file-system-access methods. For the time being, however, data that needs to be integrated and manipulated should be managed in a BIS information store, whereas other data that just needs to be retrieved and searched should be left outside of the store.

## Building the Information Store and Directory

The figure "Building the Information Store and Directory" on page 80NA 2 illustrates how data flows into BISes and data-warehousing systems. Information-store builders extract business data from source systems and load it into the appropriate information store. Existing techniques used for extracting and loading data into a data warehouse can be used to build a BIS information store, but the store builder must be able to handle a wide variety of different data structures.

Information that's loaded into the BIS and data-warehouse information stores is documented, or published, in the BIS information directory. Query, report, and analysis objects created by warehouse DSS tools are also published in the BIS information directory.

As mentioned earlier, the BIS information directory documents data stored on other systems that hasn't been extracted into the BIS store. This requires a feature for importing *meta information* (i.e., documentation about this business information) from other systems into the BIS information directory. One approach to this problem is to develop scanners that capture this meta information from the source systems.

## Distributing Information

This approach can use two different techniques to distribute information managed by BISes and data-warehousing systems to business users. The first is to allow Web users to access or pull data from the information stores (see the figure "Accessing Information" on page 80NA 2). The user employs a Web-based interface, called an *information assistant*, to search the information directory for data of interest as well as prebuilt DSS objects (i.e., queries, reports, or analyses) that can process this data. The information assistant then runs the prebuilt DSS object using the associated DSS tool and sends the output to the Web user and/or saves it in the BIS information store (or some other system). If the output is saved, its existence is published in the BIS information directory.

The information assistant also works in conjunction with the information directory to view (via Web browser plug-ins, ActiveX controls, or Java applets, for example) business information stored in the BIS store and other systems. Web search-engine technology lets the system index and search the information directory's meta information. The use of Web search engines gives business users an easy-to-use and familiar interface and provides a more powerful search capability than that typically offered by hierarchical menu-driven techniques.

The second approach to distributing information is to use delivery tools to push the data to the business users. There are two types of information delivery: schedule-driven and agent-driven (see the figure above).

With the schedule-driven technique, the information assistant finds published business information (or DSS objects) in the information directory and enters a subscription in the directory that requests that the data be delivered (or the DSS object run) at user-defined intervals. This data can be delivered to either a Web client (e.g., a Microsoft Active Desktop channel) or a Web server, or it can be sent via e-mail.

The agent-driven approach works in a similar manner, except that the subscription defines a set of business rules to monitor and informs the user if these rules are violated or satisfied. An example of such a rule would be to define a credit limit for a customer and then send e-mail to the account manager if the limit is reached.

Using delivery approaches to distributing business information offers many advantages, as listed below.

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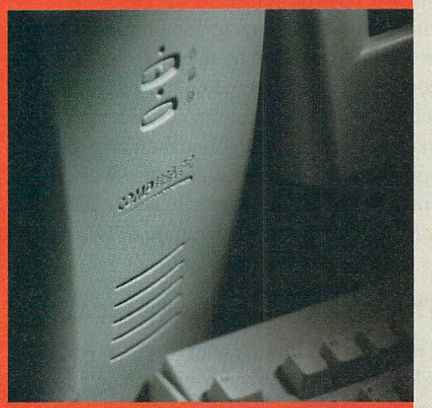
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• Easier information searching and retrieval for users who do not have in-depth knowledge of DSS systems and applications.

• Fewer errors and management problems as the number of business-information sources increases.

• The ability to balance and optimize the DSS work load, run requests during off-peak periods, and batch together requests for similar information.

• The ability to distribute information to business users in different formats and to different types of clients.

Key requirements for information-delivery tools include the following:

• An information-directory-driven publish-and-subscribe model.

• Schedule- and agent-driven information capture and delivery, with appropriate user notification.

• Information delivery to a destination of choice in a format of choice.

• Information filtering and transformation.

• Support for both explicit (via subscriptions) and implicit (via user roles) information requests.

• A consistent and tailorable Web-based user interface.

• Support for roaming (i.e., nomadic) users.

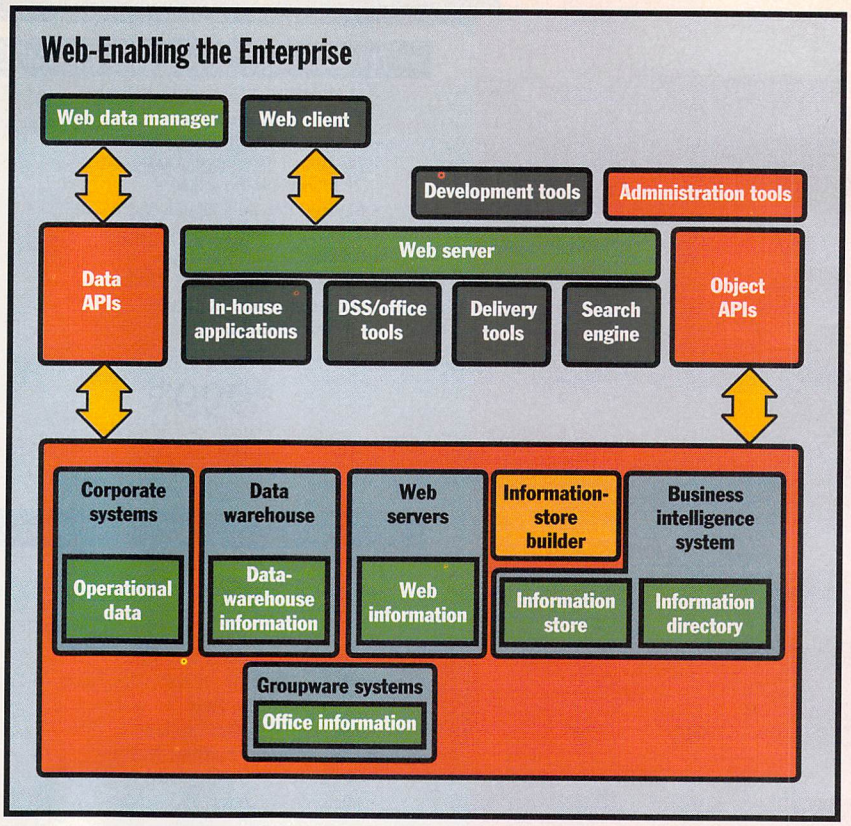
• An extensible and open architecture.

• Administration tools for managing security, integrity, performance, user enrollment, and so forth.

## Business-Intelligence Middleware

The most cost-effective approach to accessing and delivering information that is managed and documented in a BIS is to use Web-based technologies and tools. An architecture for Web-enabling enterprise systems—data-warehousing systems and BISes in particular—is shown in the figure above. This architecture consists of Web clients communicating with corporate servers managing operational, data-warehouse, business-intelligence, groupware, and intranet databases and information stores.

A middle-tier Web server running middleware service applications routes requests and results among Web clients and corporate servers. These middleware service applications support information searching, access, analysis, and delivery,




**The architecture for a Web-enabled enterprise abstracts data stores through common APIs and middleware.**

and they can be either developed in-house or supplied by tool vendors. The figure "Web Middleware" on page 80NA 8 illustrates how this three-tiered Web architecture is used to access data-warehouse and business-intelligence information.

HTML documents offer only a rudimentary end-user graphical interface for entering requests and receiving formatted results. This interface can be improved by using client-side applications written in a Microsoft ActiveX–supported language, such as VBScript, Visual Basic, and Visual C++, or languages such as Java and JavaScript. Usually these client-side applications are stored on the Web server and downloaded to the Web client as required.

Some vendor DSS tools employ client-side applications that not only add an enhanced user interface but also communicate directly with the server-based application used to retrieve information from a data warehouse or BIS information store. This latter communication is done using distributed-object-computing protocols, such as CORBA's IIOP, Java RMI, and Microsoft's DCOM, which often provide better application control and client/server state management than HTTP.

Distributed object-based DSS tools use the Web environment and HTTP to download client-side applications (e.g., Java applets) from the server to the Web client and then switch to using distributed object protocols for client-to-server application communication. Some DSS tools don't use server-side applications to access an information store; instead, once the client-side application is downloaded to the Web client, the application directly accesses the information store via database APIs, such as ODBC, OLE DB, and JDBC.

## The Product Marketplace

The two principal areas to focus on when selecting products for constructing a BIS are the database system used for managing the BIS information store, plus the tools used for distributing business information. A wide range of information-access tools are available. Most vendors of query, reporting, and OLAP DSS tools have Web-enabled their products over the past year; therefore, Web support is fast fading as a distinguishing factor among these offerings.

*continued*



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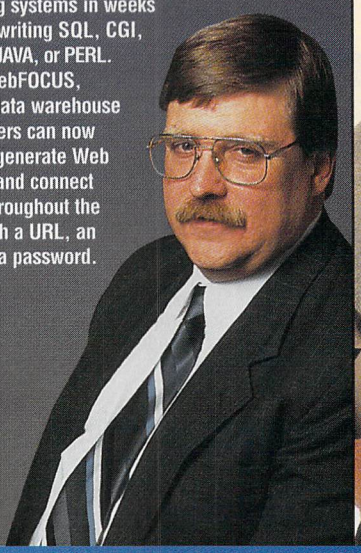
# When business wants to unite the Web and the enterprise...

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*Gary Fisher, Manager Strategic Systems, Sony Electronics Inc.*

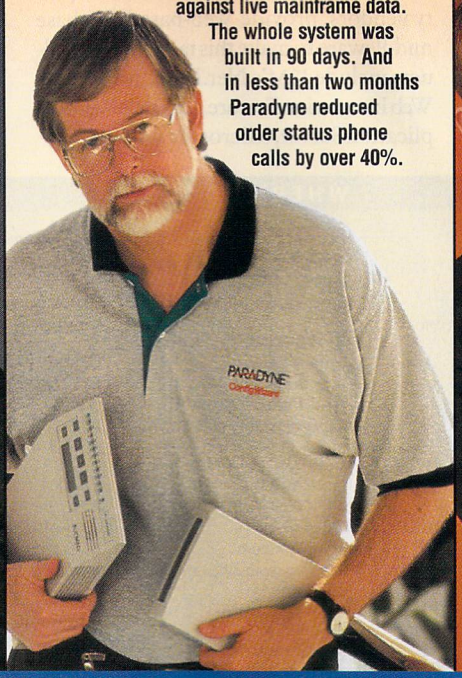
Sony Electronics Inc. decided to build a data warehouse to help manage and control its inventory. To make the information easily available to users in over 20 states throughout the U.S., the company wanted to build Web front ends for reporting and analysis. The company needed software that had report writing features, supported drill down, graphics and complex, multi-pass database queries. Sony looked at a variety of Web-based tools ranging from the very complex and expensive to the simplistic and inexpensive. The company installed WebFOCUS and had reports on their Intranet in days and drill down reporting systems in weeks without writing SQL, CGI, HTML, JAVA, or PERL. Using WebFOCUS, Sony's data warehouse developers can now quickly generate Web reports and connect users throughout the U.S. with a URL, an ID, and a password.



*"In less than two months, we reduced order status calls by 40%, enhanced customer relations, and stimulated new business by driving customers to our Web site."*

*Dan Bond, Data Warehouse Manager, Paradyne Corporation*

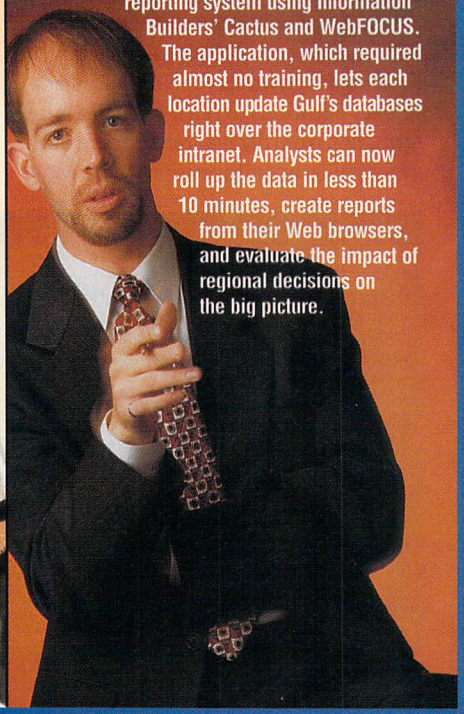
Using Information Builders EDA middleware and WebFOCUS reporting engine, Paradyne built a Web-based order status system that allows customers to launch dynamic queries against live mainframe data. The whole system was built in 90 days. And in less than two months Paradyne reduced order status phone calls by over 40%.




*"With our new intranet-based decision support system we are able to roll up budget projections in less than 10 minutes."*

*Kevin Rasmussen, Expert Application Coordinator, Gulf Canada*

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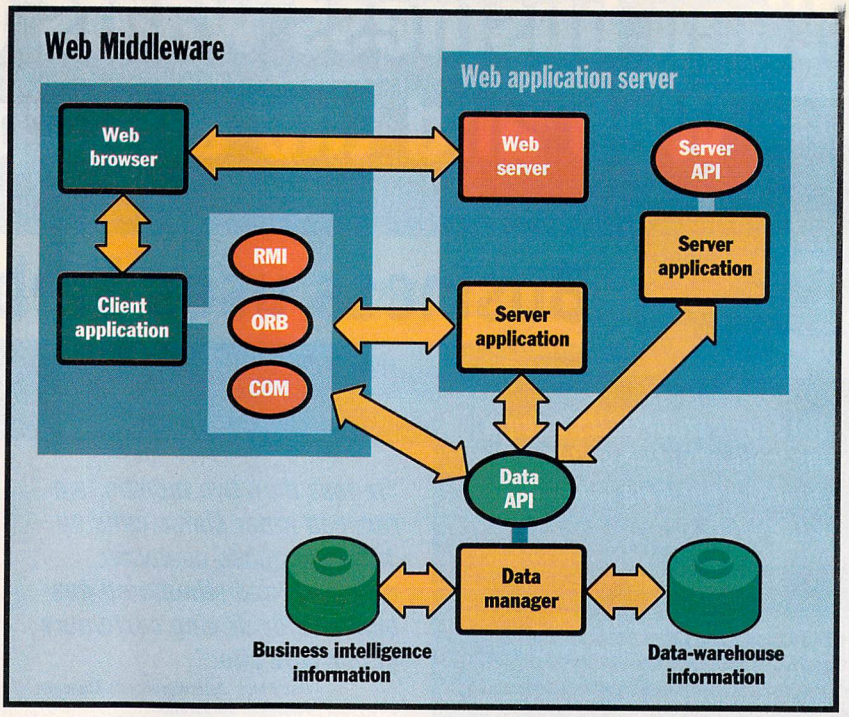
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Some key products in this category include Arbor's EssBase Web Gateway and Wired for OLAP, Business Objects' WebIntelligence, Cognos's PowerPlay Web Edition, Information Advantage's WebOLAP, MicroStrategy's DSSWeb, Oracle's Express Web Agent, and SAS Institute's SAS System. At the same time, several new vendors have appeared on the marketplace that have developed data-access tools solely for the Web environment. Examples of such tools include AlphaBlox's Enlighten, InfoSpace's SpaceSQL and SpaceOLAP, Sqribe's WebSqribe, and Zanza's Web Reports.

In the information-delivery arena, a number of DSS tools support the running and delivery of batch-report output to the Web environment. These products include Brio's Enterprise Server, Business Objects' Document Agent Server, Information Builders' WebFocus, IQ Software's IQ/LiveWeb, Oracle's Reports, and Seagate's Crystal Reports and Crystal Info. Two other new Web-based delivery tools that are worthy of mention are MicroStrategy's DSSBroadcaster and VIT's deliveryManager.

Instead of using vendor-provided information-access tools, organizations can develop their own server-side (and client-side) applications to retrieve business information from data-warehouse and business-intelligence information stores. Most database vendors, and several third-party vendors, provide Web-based database middleware to make this task easier. Products include IBM's Net.Data, Informix's Web Integration Feature, Oracle's Web Application Server, Microsoft's Active Server Pages, Sybase's Web.Works, Allaire's Cold Fusion, and NetDynamics. B




**Middleware between the HTTP server and the enterprise is the key for Web-enabled techniques.**

*Colin White is president of DataBase Associates International, Inc. (Morgan Hill, CA). You can contact him at* **cwhite@dbaint.com.**

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# Web Project



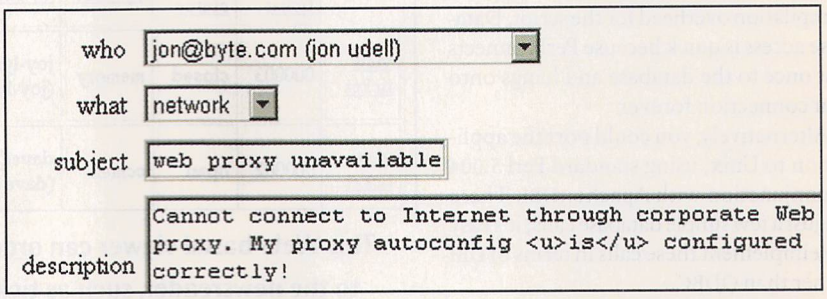
# Building NNTP Groupware

*Hybridized Web/NNTP technology is almost, but not quite, a credible platform for serious groupware development.*

The version 4.0 mail and news clients from both Netscape and Microsoft delivered the same HTML/JavaScript features that are available in the Web browsers. Why? Netscape wants to position HTML-aware messaging, particularly its NNTP flavor, as a platform for groupware. Microsoft, though heavily invested in Exchange, had to follow suit.

One of our public conferences (*news://dev4.byte.com/htmlnntpcon*) focuses on exploring what these HTML-aware news clients can and cannot do. The conference has also debated whether you can build useful groupware applications using enriched NNTP. This month's experiment, a simple help-desk application, reveals both the strengths and the weaknesses of NNTP-based groupware. Here's what users of this application can do:

- Open trouble tickets. A Web-based HTML form (see the screen above) feeds data into two repositories. One rendering of the data becomes an HTML message that is automatically posted to the newsgroup helpdesk.open. Another rendering populates a SQL database that's viewable on a Web page.
- Discuss trouble tickets. Each ticket becomes a top-level posting to the newsgroup helpdesk.open (see the top screen on page 82). From their newsreaders, users can post questions, clarifications, or solutions.
- Close trouble tickets. The HTML message that's generated for each automatically posted ticket includes a form that you can use to close the ticket with an explanation of the fix. The form's Submit button invokes a Web-based script that does the following: 1) Updates the SQL record for this ticket, setting the status to "closed" and adding the explanation; 2) Removes the NNTP messages for this ticket from the newsgroup helpdesk.open; 3) Rewrites the primary NNTP message for this ticket, updating the status and explanation fields to match the SQL record; and 4) Reposts the NNTP messages for this ticket to the newsgroup helpdesk.closed.
- View a database of trouble tickets. On the news side, the newsgroups helpdesk.open and helpdesk.closed offer the normal newsreader views. You can sort by subject (in this case, ticket number), date, and sender. On the Web side (see the bottom screen on page 82), you can sort the SQL database by these fields and also by ticket category (e.g., network) and status (open or closed).
- Search the helpdesk newsgroups. If you use Collabra Server and Communicator, users can do full-text searches against the newsgroups.
- Upload/download binary files. Fixes often involve software or driver updates. You can upload them as responses to closed tickets, located by means of browsing or searching, and download them as needed.




**This Web form feeds into a newsgroup as a structured NNTP/HTML message. The data is also mirrored into a SQL database.**

Clearly, this application exhibits many of the characteristics of groupware. It manages both structured and semistructured data. It implements a simple work flow. It associates every action with a user. It supports and encourages collaboration.

Is it practical to build this application? Yes, and I'll show you how. Is it practical to use this application? Probably not, I'm afraid. The current crop of NNTP clients are not quite up to par. I'll explain why not and suggest some fixes.

## Help-Desk Application Components

The engine that drives the help-desk application is an HTTP server that talks to NNTP and SQL data stores, and that generates NNTP messages and Web pages. I could have implemented the engine as a Perl script that would plug into Apache or Internet Information Server (IIS). But it turned out to be simpler to build a special-purpose HTTP server such as the ones I discussed last month. So the kit that's available this month (*http://www.byte.com/art/download/helpdesk.zip*) includes both a minimal HTTP server and the help-desk application.

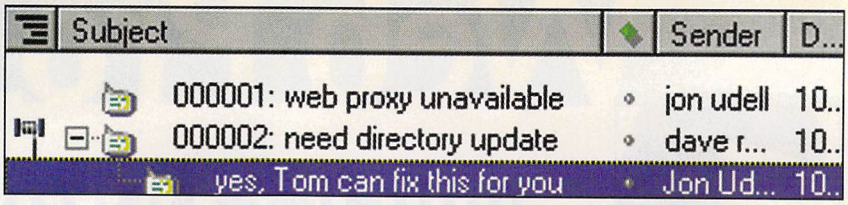
No NNTP server is included, however,

PHOTOGRAPH: KELLIE WALSH © 1998

so you'll need to supply that piece. Collabra is a good choice because it supports full-text searches. But any NNTP server will work, including good old INN. The application uses the inews utility (available with any NNTP implementation) to post and cancel news messages.

The SQL substrate can be any ODBC data source. I'm using a Jet-managed .MDB file. Although it needn't necessarily be so, the kit I'm providing is Win32-specific. Why? A Win32-Perl-based HTTP server talking to the Jet database engine handily solves both major problems of Web/database integration. The code runs quickly because there's no launch overhead for Perl and no compilation overhead for the script. Database access is quick because Perl connects just once to the database and hangs onto that connection forever.

Alternatively, you could port the application to Unix, using standard Perl 5.004 in conjunction with Apache::DBI. There are just a few simple database calls; it's easy to reimplement these calls in terms of DBI rather than ODBC.




**Free-form discussion can bind to any automatically posted trouble ticket. Users can converse or upload/download attachments.**

**helpdesk ticket viewer**

| | by ticket | by status | by class | by who | by subject | resolution |
|---|---|---|---|---|---|---|
| view ticket | 000003 | closed | memory | joy-lyn@byte.com (joy-lyn) | need more ram | OK, you're up to 128MB now. -- Tom |
| view ticket | 000002 | open | ccmail | dave@byte.com (dave rowell) | need directory update | |

**This Web-based viewer can order the tickets by fields unknown to the newsreader, such as ticket status or problem category.**

## Auto-Posting NNTP Messages

When a user submits a new open ticket, the form's handler allocates the next available ticket number. Then it reads a message template and interpolates the ticket number and the form data into that template.

The template begins with NNTP headers such as Newsgroups and From. It continues with HTML constructs such as metatags, a table, and a form. Why metatags? They're not required, but it's no trouble to include them. Doing so paves the way for fielded searches using one of the indexing engines that can recognize metatags as field declarations.

The server saves the rewritten template to a temporary file and posts it to the newsgroup like this: inews -h temp. At the same time, it inserts a matching record into the SQL database.

Because the NNTP message is an HTML document, does the application require any conventional Web pages? In theory it doesn't, but in practice it does. For example, I tried adding to each trouble ticket all the user-interface (UI) stuff you would normally expect to find on a home page. The resulting distributed UI, although technically feasible, turns out to be ineffective just because it does violate normal expectations. Therefore, I consolidated the application's main functions onto a home page and included a link to that page on every ticket.

## Reorganizing the Message Base

Auto-posting is the foundation of any NNTP-based groupware system. By controlling inputs, you can guarantee that messages carry the custom fields that add structure to the message base. Next, you'll want to be able to programmatically reorganize the message base. In this case, I wanted to use newsgroup structure to represent a simple work flow: When you close a ticket, it moves from helpdesk.open to helpdesk.closed.

NNTP was never designed for this kind of thing, and it doesn't provide a function to move a message, only functions to post or cancel a message. You can, however, construct a move function from these primitives—cancel from one group and then repost to another.

In the help-desk application, every ticket includes the form that can be used to close that ticket. That form calls a URL that looks like this: /close_ticket?ticknum=12. Unfortunately, ticket 12 means nothing to the NNTP server. It only keeps track of message IDs, so ideally the URL that removes ticket 12 should look like this: /close_ticket?msgId=320A743.451F@byte.com. But there's a catch-22. When the application server creates the ticket, it doesn't know what the message's ID will be.

What's the solution? Use a forward reference. Encode what is known at template-processing time—the ticket number—and use that datum to associate the ticket with a message ID at ticket-closing time. The application does this with a pair of functions:

```
my $msgfile = &getFilenum-
  FromTicknum($ticknum,'open');
my $msgid = &getMsgIdFrom-
  Filenum($msgfile,'open');
```

Suppose the ticket number is 12, the message ID is 320A743.451F@byte.com, and the file containing the message is /helpdesk/open/73. `GetFilenumFromTicknum` scans the directory /helpdesk/open for the file containing ticket 12. How? It looks for the header "Subject: 12" and returns the filename 73. Now, `getMsgIdFromFilenum` can open file 73 and return the value of the message ID header.

With the message ID in hand, the server can build a cancel message:

From: help desk
Newsgroups: it.helpdesk.open
Subject: cmsg cancel 320A743.451F
@byte.com



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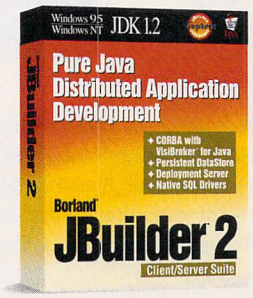
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Control: cancel 320A743.451F@byte.com

and call inews to post the cancel message.

Next, the application reposts the ticket to helpdesk.closed. It uses file 73 as the template for this new message but alters it in a couple of ways. First, it changes the Newsgroups: header from helpdesk.open to helpdesk.closed. Then, because you can't reuse message IDs, it deletes that header, which forces the NNTP server to assign a new ID to the reposted message. Finally, it changes the status field of the ticket to closed and adds the explanation that was supplied on the form.

## Moving Message Subtrees

Suppose a subtree of responses sprouted under ticket 12. What happens to the messages when you close ticket 12? They are orphaned. Each one has a header like this: References: 320A743.451F@byte.com. NNTP newsreaders use the headers to infer thread hierarchy. When a referenced message ID vanishes, a newsreader throws up its hands and promotes the referring message to the status of a top-level posting.

Can you use the same cancel/repost trick to move a response subtree? Yes. The help-desk application uses another function, `getFilenumsReferencingID`, to round up all the messages in helpdesk.open that refer to the now-closed ticket 12. These messages receive the same transformations applied to ticket 12. In addition, their References: header is pointed at ticket 12's message ID. Note that this is ticket 12's new message ID, the one it acquired when it was reposted to helpdesk.closed, not the old one it had when it was in helpdesk.closed.

The resulting effect is magical. When you close a ticket that has a response subtree, the whole clump of messages vanishes from helpdesk.open and reappears in helpdesk.closed. I did take one shortcut. The substructure of the relocated subtree gets flattened. To preserve that substructure would require transitive use of `getFilenumsReferencingID`, tracking down through each level of response hierarchy. It's a feasible enhancement, but it was eclipsed by a much bigger problem.

## Cache Confusion and Other Woes

Although the application really does reorganize the NNTP message base in the ways I've described, the Communicator and Internet Explorer newsreaders don't always see the new structure promptly and accurately. As I've said, NNTP technology is (so far) not really designed for this kind of interactive use. Both Communicator and Internet Explorer seemed to have trouble catching up with the changes.

Worse, they behave in seemingly nondeterministic ways. For example, Communicator sometimes correctly removes canceled messages from helpdesk.open, sometimes incorrectly displays headers and messages, and sometimes incorrectly displays headers only.

This was a showstopper. Although you can clear up these synchronization problems by unsubscribing from the affected newsgroups, restarting the browser, and then resubscribing to those newsgroups, you can't expect most users to do that.

An equally vexing problem is the lack of a single container to frame the news and Web components of the application. Using a mixture of *news:*// and *http:*// URLs, it can refer back and forth between Web pages and newsgroup messages, but these pieces don't cohere into something that feels like a single application.

For these reasons, the help desk in its current form can't be deployed to its original target group—the entire staff of BYTE. It may, however, meet the needs of our information-technology (IT) team. They say they're willing to tolerate the UI rough edges in order to realize the benefits that the application does offer: simple work flow and free-form collaboration built around a structured core. It might even be worthwhile to cleave the application into two independent parts. Everyone could benefit from the free-form collaboration available in the newsgroup. Meanwhile, the IT team could privately exploit the Web-enhanced features.

## Future Opportunities for NNTP Groupware

Here are some ideas for unleashing the full potential of NNTP groupware:

1 **User-defined headers.** As I've mentioned before, it's tantalizing to imagine a newsreader that can display and sort views that include fields other than subject, sender, and date. Given that capability, I probably wouldn't have had to provide a Web-based ticket viewer.

2 **Newsreader object model.** Full-text search in Collabra, for example, is a fairly obscure feature. JavaScript control of the search mechanism would enable developers to present it more effectively to users and also to exploit it programmatically.

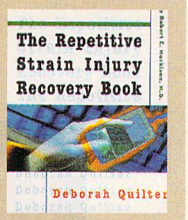
3 **Tiled-window presentation of browser/newsreader.** The current overlapping-window implementations are quite inhospitable to applications that try to merge the features of Web and NNTP clients. Although you can probably park a Java-based newsreader in a frame of a Web page, that approach gives away much performance and functionality.

Will these things ever happen? Until recently, the only answer was to wait and see what Netscape and Microsoft do. Now that Communicator is an open-source product, there's a startling new possibility: Do it yourself. Not me—I'm allergic to C++ GUI programming—but you, the reader of this column, could help move Communicator in this direction if you think it's worthwhile. We do indeed live in interesting times! B

*Jon Udell is BYTE's executive editor for new media. You can reach him at* **jon.udell@byte.com.**

## BOOKNOTE

### The Repetitive Strain Injury Recovery Book ($14.95)




**by Deborah Quilter**
**Walker and Co.**
**ISBN 0-8027-7514-4**

**As some of us here at BYTE have learned, RSI problems have no easy solutions. Like Quilter's earlier book, Repetitive Strain Injury: A Computer User's Guide, this one offers thoughtful, informed, and wide-ranging advice.**

## TOOLWATCH

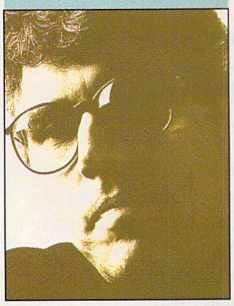
### NetMeeting 2.1 (free)

**http://www.microsoft.com/netmeeting/**

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Rick Grehan

# Javatalk



## Inprise's JBuilder—Take 2

*Inprise's latest iteration of its JBuilder Java RAD environment has clever embellishments.*

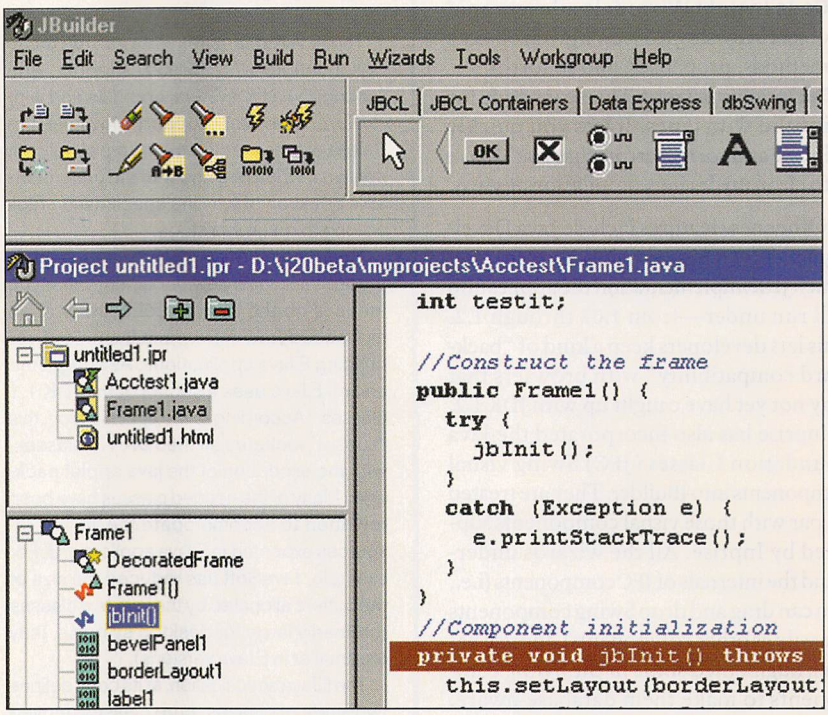
The latest version of JBuilder lets you build professional-looking Java programs more quickly while maintaining backward compatibility with older browsers. I looked at a beta version of this rapid application development (RAD) environment from Inprise (which is the new name of Borland International). JBuilder 2.0 should be available by the time you read this.

The JBuilder integrated development environment's (IDE's) home plate is a multipaned window, referred to as the AppBrowser. The Navigation pane (upper left in the AppBrowser) operates with the Structure pane (below the Navigation pane) to provide multiple browsing views into the application.

For example, if you open a Java source file in the Navigation pane, a tree view into the objects within that file appears in the Structure pane. You can browse through this tree view to instantly locate method definitions, variable definitions, and imported class definitions. Select, for example, a method, and the source code appears in the Content pane (the right-hand pane), with the method's definition positioned and highlighted.

Constructing an application within JBuilder follows the familiar drag-and-drop style made popular by Visual Basic. The GUI portion of an application consists of a collection of windows (or frames). You build the application by dragging and dropping visual components (drawn from tool palettes) onto the frame. JBuilder automatically deposits into the application the code needed to support the visual objects.

For many visual Java development systems, this drag-and-drop style of programming is problematic, particularly when the environment attempts to provide object behavior at development time. (In other words, making buttons, scroll bars, and so forth active while the application is being built.) Some development systems resort to recording "tags" directly in project source code.




**JBuilder's AppBrowser allows visual navigation through your source code's objects.**

These tags carry parametric information about visual objects (e.g., button size or text) and usually appear as encoded text, wrapped inside a comment statement and guarded by large warning messages that read: "DO NOT DELETE THIS COMMENT." The reason is that the IDE needs this information to create the GUI portion of the application at development time. Messing with the comments will put the IDE's view of the application out of sync with the source code.

JBuilder doesn't do this. It is intelligent enough to identify those methods in source code that are responsible for manipulating visual components. While designing an application, if you change the source code, the affected visual components are appropriately altered. Similarly, modify the visual component, and the source code tracks properly.

JBuilder 2 has a variety of additional features, most of which are contained in the wizard category. These new wizards are grouped under the umbrella term

PHOTOGRAPH: KELLIE WALSH © 1998

Code Insight and consist of the following:

- **Package Wizard:** A visual tool for importing packages into a Java application.
- **Code Completion Wizard:** This speed-tip feature lets you type only a portion of the name of a property, method, or event. It looks up all pertinent names and completes the spelling for you.
- **Code Parameter Wizard:** Another speed-tip feature, this wizard provides a quickly accessed list of method prototypes (extremely useful for making sure that you've selected the proper method from among however many overloaded aliases are available).
- **Code Insight Wizard:** It allows rapid object browsing (to view a given object's methods, properties, and so forth).
- **Declaration Wizard:** This scans code for invalid data types. It lets you quickly locate and correct errors that you'd have to clean up during compilation anyway.

Other new features include Java Development Kit (JDK) switching. You can select which JDK implementation the application will run under—from 1.02 through 1.2. This lets developers keep a kind of "backward compatibility" with browsers that may not yet have caught up with JDK 1.2.

Inprise has also incorporated the Java Foundation Classes (JFC) Swing visual components into JBuilder. They are treated on par with those visual components supplied by Inprise. All the wizards understand the internals of JFC components (i.e., you can drag and drop Swing components as easily as other components). Inprise has even augmented some of the Swing components to make them database-aware. (The documentation describes the augmentations as being a thin wrapper on top of the original Swing component.)

The client/server edition of JBuilder (which I reviewed) crams more packages onto the CD-ROM than just JBuilder. Most of the additional packages are (understandably) database products. These include Data Gateway, which provides Java connectivity to a host of Windows NT databases (Access, Oracle, Paradoc, dBase, Interbase, FoxPro, Sybase, and others); Interclient, a Java Database Connectivity (JDBC) driver for Inprise's Interbase (also included); and Object Design's ObjectStore persistent storage engine (PSE).

The JBuilder CD also includes Netscape's Navigator 4.03 and Microsoft's Internet Explorer 4.0 (saving a download from the Internet) as well as a trial edition of Inprise's IntraBuilder Dynamic HTML (DHTML) development system.

The system requirements for a development system continue to expand. JBuilder (for NT and 95 systems) needs at least 48 MB of RAM (and documentation recommends 64 MB). A "compact" installation of JBuilder takes about 100 MB of disk space. Of course, with all the additional supplied products, the disk-space requirements can vary wildly—depending on what you do or don't install.

Inprise has announced three levels of JBuilder: client/server ($2495), professional ($799.95), and standard ($100). Contact Inprise for details. Among Java development environments I've tried, this is one of the nicest to work with—particularly because of the two-way design. B

*Rick Grehan (Hancock, NH) works for Metrowerks' Discover Products division. You can reach him at* **rgrehan@austin.metrowerks.com.**

**WHERE TO FIND**

**Inprise Corp.**
Scotts Valley, CA
408-431-1000
fax: 408-431-1320
http://www.inprise.com

## Embedded Java Spec Arrives

In March, JavaSoft released the draft version of the much-awaited embedded Java (EJava) specification. It is available for downloading from the JavaSoft Web site (*http://www.javasoft.com*). Though admittedly a draft, the specification itself is unusually brief. It focuses on listing those Java Development Kit (JDK) 1.1 classes that are either required or optional in an EJava implementation.

Here's an example of the specification's brevity. In the section on real-time OS (RTOS) requirements, the specification states that the underlying RTOS must meet a "few minimum requirements."

Those listed requirements include memory management, thread support, and (optionally) a file system, graphics and windows, and network support. However, the details of these requirements are simply not spelled out, leaving one with the uncomfortable question of why the specification took so long to reach this stage.

You'll find more nourishing information in the technical overview document. Here, the focus is on the overall architecture of an embedded Java system and the process of building EJava applications. As suggested above, EJava uses a subset of the JDK 1.1 classes. (According to the specification, this "subset" includes all the JDK 1.1 classes, with the exception of the java.applet package.) Many of the needed classes have been rewritten to accommodate the limited resources expected in EJava applications. For example, JavaSoft has reduced the size of the buffers allocated by the java.text classes (ordinarily large for desktop systems, they are smaller in EJava versions).

The EJava specification, at its core, defines two kinds of classes: core classes derived from JDK 1.1 and hardware-specific classes (whose methods deal with the specific target hardware). Both are "configurable," in that the developer will be able to make run-time trade-offs between memory requirements and feature sets. (How this will work is not made clear in either the specification or the technical paper.)

Constructing an EJava application is an involved process that requires the use of a number of tools that JavaSoft will soon provide. Developers begin with JavaConfig, a tool that lets you specify the details of classfile and virtual machine (VM) support. (For example, if the final application will not require dynamic class loading, the VM's verifier can be removed. The specification hints at a "preverifier," a separate tool that you can run against classfiles that will become part of the final EJava application.)

The JavaConfig tool emits the "foundational" classes and properly configured JVM. Next, you run JavaFilter on your application files; JavaFilter determines which methods and fields (from each class) are actually used in the application. The generated information is passed to the Java Code Compact tool, which removes the unneeded components and generates a–get this–C source code file that represents the application's run-time code. A similar tool, Java Data Compact, examines your application's static data and generates a C source code file whose compacted data is suitable for ROM-ing.

The results of Java Code Compact and Java Data Compact are passed through a native compiler (which generates code for the target processor) and then linked with the native methods (those that communicate with the hardware), the VM, and any object files required to interface with the native RTOS.

The result is a ROMlet, a binary image of the application, ready to be burned into ROM or downloaded into nonvolatile memory (e.g., flash).

Udo Flohr

# FutureVision



## Computers with Attitude

*How smart can a computer be if it doesn't understand your feelings?*

Emotional intelligence, says Dr. Bernhard Kämmerer of the Siemens Human-Machine Research Group, is not just the latest pop psyche buzzword: It's also a quality that would be attractive for a computer to have. Today's interactions with machines, Kämmerer explains, "always stay the same, whether the user is in a hurry, angry, happy, or under stress. They're controlled by hard-wired instructions, often initiated by a key press."

But we humans behave in a completely different manner. If we detect agreement (maybe through nodding, a happy face, or affirmative utterances, such as "Yes!"), we continue our "proven" way of behavior. If, however, we detect signs that show the person we're interacting with is unhappy, we're likely to change our communicative strategy.

Accordingly, Kämmerer and his team are teaching devices how to detect time-winning utterances, such as "um"; weak speech; inquiring facial expressions; finger movements; anger; and timidity, as well as how to distinguish such behaviour from clear commands and actions. Emotional intelligence, these scientists propose, will help machines recognize and adapt to users' actions and intentions, offering help and support when needed or scaling down the amount of interaction to fit stressful situations.

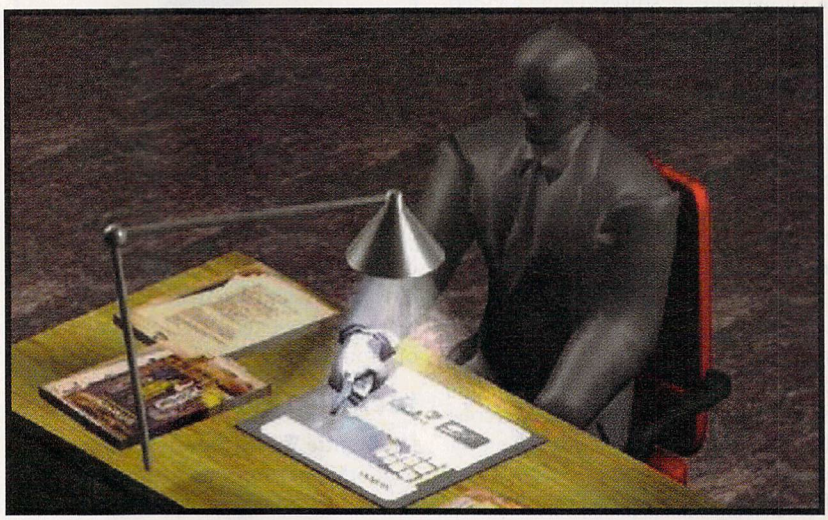
You might find that overly cute for an office environment. But wouldn't it be nice if your computer could screen phone calls when you're on deadline, warn you of dangerous actions when you're tired, and have the good sense not to crash when you have a plane to catch?

Such capabilities would definitely be useful in a public kiosk system, which could detect each user's level of skill. And they would be downright critical in any kind of cockpit: While advanced onboard computers should know that too much speed is as dangerous in a car as a lack of it is in a plane, it would be an important safety feature if they could detect a bored driver or an angry pilot.

By the same token, these devices would reflect their system status through "emotions"—conveying alarms urgently with loud and concise voice prompts, while general information, spoken e-mail, tourist information, and the like would be presented conversationally, with fancier graphics and well-modulated speech, when they sense that the time is right.

Some of this might sound uncannily like Bob, Microsoft's ill-fated Windows interface enhancement of yore. And what about those lapel pins in Bill Gates' new residence, which the household computer uses to adjust ambient lighting, music, and so on, to an individual guest's taste?

But Kämmerer takes issue with that comparison. After all, when you arrive as a houseguest of the Leader of the Free World, you must state your preferences by filling out a form. To the best of our knowledge, the system stoically follows that list, unheedful of your momentary moods and needs. No intelligence there.



**PCLamp is not just an embedded computer; it responds to the user's gestures and mood.**

So what will the devices envisioned by the Siemens researchers look like? The concept of computers with an emotion quotient, or EQ, mainly involves software. But these systems' approach to ergonomics is also more comprehensive.

Lots of keys and displays, Kämmerer says, "frustrate users and overload their reception capacity." Therefore, "real or virtual fields of interaction" will be reduced to a minimum. Embedded systems for home control might appear as "retro-styled hardware"—maybe an old-fash-

PHOTOGRAPH: HOLGER FLOSS/LIAISON INTERNATIONAL © 1998

ioned shutter or light switch—"but offering all the new goodies for interaction." And even computers as we now know them could one day be completely invisible, perhaps appearing on a stylish piece of furniture only when needed.

## A Bright Idea

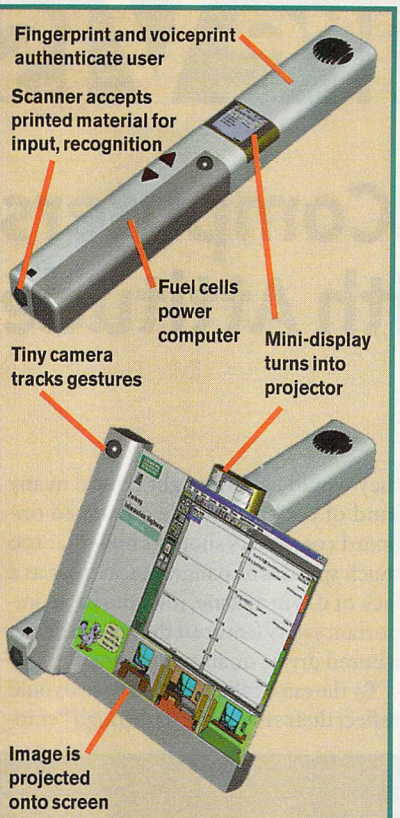
One such solution for crowded desktops goes by the slightly corny designation of PCLamp. It combines a traditional light bulb with a projection device. Activated by voice, touch, or automatically should urgent messages arrive, the lamp projects a virtual screen onto a desk surface, which otherwise stays free for "important things, such as magazines and beer glasses," according to Kämmerer.

PCLamp can act as a PC, gaming, or Internet-access device, and it doubles as a telephone, calculator, TV/audio remote, and smart-home control. The shape of its virtual display changes according to the current function. It accepts voice input for commands, dialogues, and dictation, and it acknowledges gestures: Using a video camera, it interprets a user's finger movements and facial expressions, as both point-and-click or other predefined command signs and emotions. Optionally, it adjusts the display to a user's head movements and line of sight.

This is by no means science fiction; a simplified version of PCLamp won BYTE's Best of Show award at CeBIT '98. In essence, the technology creates a virtual touchscreen. It's useful for many scenarios where a monitor is inappropriate or inconvenient. In a sterile hospital operating room, for example, a doctor could consult computerized diagnostics directly over the patient.

Peter Kleinschmidt, who founded the research group, showed me a prototype of PCLamp three years ago, but only now is an aggressive marketing strategy emerging. If proof-of-concept studies win over outside pilot users, that will heighten the enticement for inside departments or spin-off companies (which Siemens calls Ventures) to adopt the project and turn it into products.

The Center for Human-Machine Cooperation is located at the Siemens headquarters in Perlach, a suburb of Munich. It employs about 50 researchers and has an annual budget of around US$10 million, 50 percent of which the team has to earn by selling projects to other departments. It's part of Siemens's central technology division (Zentrale Technik), which employs 1650 scientists. Worldwide, the German giant has 44,600 R&D employees, out of a total work force of 380,000.




StylusPhone becomes a computer. Sophisticated biometrics ensure security.

## Identity Crisis

Dr. Brigitte Wirtz is a primary researcher in another of the group's specialties: biometrics. As the advent of e-commerce and worldwide connections makes secure access more important than ever, Wirtz explains, authentication procedures that require PINs, passwords, keys, or even smartcards are "old-fashioned and boring and do not ensure the right person, but only knowledge or possession."

Biometric verification looks at human characteristics such as voice, fingerprints, and writing style. More advanced devices should not just recognize a user, Kämmerer says, but they should also know his or her permissions. They would, for example, let children use their parents' mobile phone but block long-distance and home-shopping calls.

Fine-tuning a particular biometrics technology means keeping the number of false acceptances (but also false rejections) to a minimum. To test her signature-verification technology, Wirtz collected thousands of autograph samples in 10 sessions spread over a period of five weeks or more. This allowed for variations in a person's signature, which a bank teller, for example, would encounter.

She then invited forgers to choose a signature they found easy to fake, gave them time to practice, and even described the dynamic characteristics of the original autograph. Finally, she let the forgers train against her system. Six thousand forgeries were thus collected before Wirtz was satisfied with her software: False acceptances are just 3 percent if skilled forgers are involved; otherwise, they're 1 percent.

StylusPhone, also from the Siemens group, uses fingerprint and speech biometrics for identification. It looks up a number when the user gives it a name, but it can also interpret spoken dialogue and turn it into a query for information retrieval. A built-in OCR scanner allows the user to place calls by reading a number or a name, perhaps from a business card.

But StylusPhone does more. Place it on a table and unfold the projection screen, and voilà: A display for PC-like interaction appears. The display can now show a schedule, a Web browser, or a videoconference. A tiny camera at the top of the screen observes gestures and finger movements and controls the cursor. For extended periods of operation time, a StylusPhone can be powered by tiny fuel cells, which are recharged like a gas lighter.

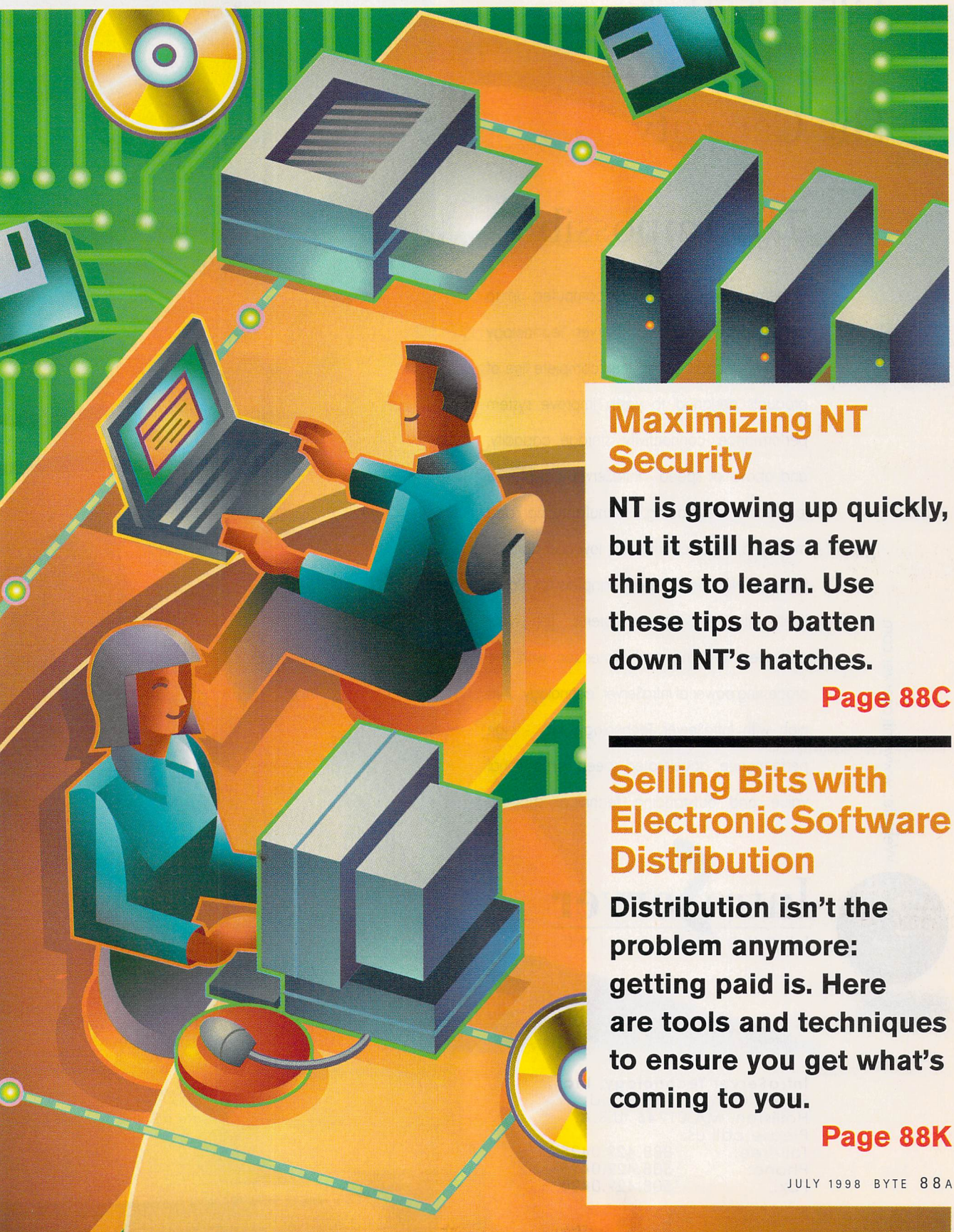
So, even if emotional intelligence is somewhat of an oxymoron to you, perhaps we can all agree that we want computers and technology to adapt to us, not the other way around. Today, much of the work in this area focuses on size: We have palmtops, hand-helds, laptops, and desktops. Already, devices are changing shape through convergence, which blurs the traditional distinctions among TVs, phones, PCs, and so on. By exploring the broader issues of interactive style and integration into the environment—to the point of making technology invisible—Kämmerer and his crew are pushing the envelope further. B

*Udo Flohr is a BYTE contributing editor who writes about advanced technologies. He is based in Hannover, Germany. You can reach him by sending e-mail to* **flohr@dfn.de**.



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## Maximizing NT Security

**NT is growing up quickly, but it still has a few things to learn. Use these tips to batten down NT's hatches.**

**Page 88C**

## Selling Bits with Electronic Software Distribution

**Distribution isn't the problem anymore: getting paid is. Here are tools and techniques to ensure you get what's coming to you.**

**Page 88K**

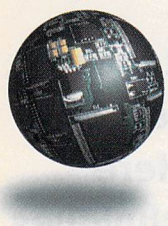
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*Put NT's own security features to work to shield your system from unauthorized use.* ***By Stephen Cobb and David Brussin***

# Maximizing NT Security

The rise of Windows NT as a platform for serious business systems is well known. Less well known is the rise of instances of people asking, "How do I install and run NT as a secure platform for serious business systems?"

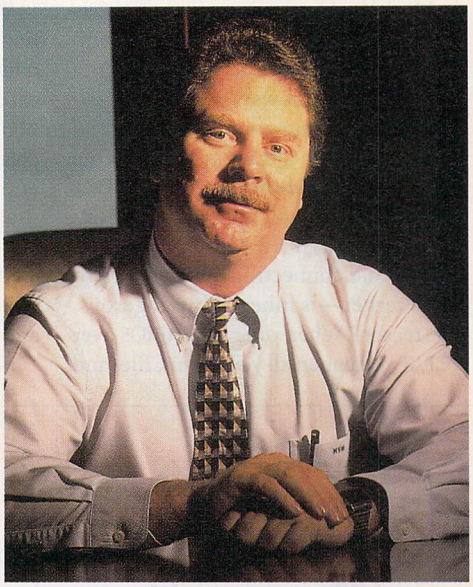
Unfortunately, Microsoft has done such a brilliant marketing job that some have no trouble believing that a complete answer could fit into a single article. We hate to deflate great expectations, but NT security isn't that simple. Whoever thinks it is has a rude awakening in store—probably after the compromise of valuable data. However, a single article can provide a starting point for your efforts to maximize NT security.

## The Mists of Misperception

A compass guiding you through the fog is a helpful image to envision when journeying to secure computing with NT. Just substitute the phrase "security savvy" for "magnetic north." Unfortunately, few products come with security savvy included, and NT is no exception. What is security savvy? Made up of equal parts paranoia and cunning, as well as technical skill and human insight, it's the ability to see security implications where others don't in order to anticipate the ways in which other people will try to abuse, misuse, and subvert an information system. When you analyze the long-running argument about which is more secure, Unix or NT, one of the main advantages Unix has is years of accumulated security savvy.

This brings us to the starting point for seekers of NT security: a clear perception of the product. NT is a powerful OS with sophisticated security capabilities. However, it's not as mature as older OSes, and it's "not locked down out of the box, especially on Windows NT Workstation." These are the words of Microsoft (from a presentation by Microsoft NT security product manager Jason Garms). In other words, there are many security features in NT, and it can provide a relatively safe operating environment. But NT will not achieve that unless well-trained, security-savvy personnel install and administer it.

The next point to be clear on is that secure networking with NT means NT Server. NT Workstation is a fine client OS, but only for peer-to-peer networking within highly trusted environments with no outside connectivity. What's a highly trusted



**The security potential of Windows NT cannot be realized without some serious tinkering and careful ongoing administration.**

**—Mark Van Holsbeck director, enterprise network security Avery Dennison Corp.**

PHOTOGRAPH: THEO FRIDLIZIUS © 1998

environment? One that is physically secure and populated by users who are all as honest and diligent as you are. Since this is rare indeed, peer-to-peer networking is rarely appropriate. You can determine appropriate security only after a proper assessment of the value of your network and the risks it faces.

After your assessment comes policy. This involves deciding whom you will allow to do what, and how they'll be able to go about doing it.

## Where to Begin?

As Mark Van Holsbeck, director of enterprise network security for Avery Dennison (Pasadena, CA), puts it, "the security potential of Windows NT cannot be realized without some serious tinkering and careful ongoing administration." One basic factor for safe networking with NT is the protocols you use. Running NetBIOS over TCP/IP on your internal network—and connecting that network to the Internet—is inherently dangerous. The reason? When you run NetBIOS over TCP/IP, you open all your print, file, and application sharing services to any system that runs TCP/IP—that is, any computer on the Internet. Not very secure.

The simplest solution is to disable NetBIOS over TCP/IP with the Network applet on the Control Panel. Then run native Microsoft file, print, and application services with NetBIOS over either IPX/SPX or NetBEUI. These are harder for a hacker to access over the Internet. Because you can run TCP/IP internally without running NetBIOS over TCP/IP, your systems can still access the usual TCP/IP and Internet services.

What if design or political considerations prevent you from disabling NetBIOS over TCP/IP? Policy collides with practical considerations. If you must have NetBIOS over TCP/IP, you need to run any connection between the internal network and the Internet through a firewall to filter out traffic on the sockets used for NetBIOS traffic (UDP 137, UDP 138, and TCP 139). This will prevent NetBIOS traffic from flowing between your network and the Internet.

Note that the firewall itself does not have to run NT—and it might be safer if it didn't. Using a different OS for the firewall adds defense-in-depth, not to mention that some newer NT firewalls have not done well in recent tests by the International Computer Security Association.

With regard to NT installation, choose NT File System (NTFS) over FAT. If you already use FAT, you can switch to NTFS with the CONVERT utility. NTFS volumes can apply access-control lists (ACLs) to files and directories. FAT cannot.

NTFS is essential for implementing policies to maximize NT security. Once you do the initial installation, find out which Service Packs and security-related hot fixes to install (see the text box on page 88H). Note that you must install some patches in a specific sequence for them to work properly. NT vulnerabilities will continue to come to light, and it's unlikely that the code on the CD will be completely up to date in this regard.

## Safety Measures

Since your NT security efforts are an implementation of your organization's secu-


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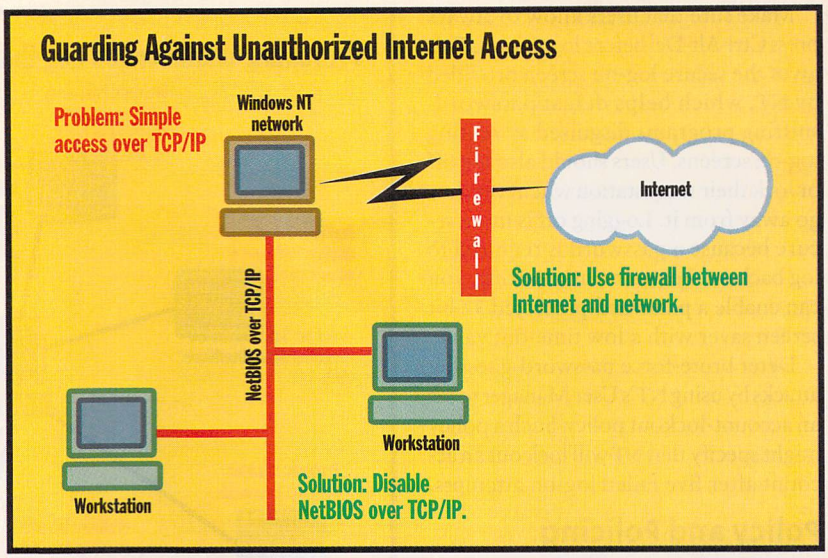

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rity policy, one of the first things to do is capitalize on NT's ability to notify users of their legal liability for unauthorized use of the network. You can display this warning in a custom dialog box that appears before a user logs on. Assign the following registry key values on the system. (Back up the registry before editing it; read regedit.hlp for help.) You can also do this with the System Policy Editor in NT 4.0 or with C2CONFIG.EXE.

```
Key: HKLM\SOFTWARE\Microsoft\
  Windows NT\Current Version\
    Winlogon
Value: LegalCaption (REG_SZ):
  Your message box title
Key: HKLM\SOFTWARE\Microsoft\
  Windows NT\Current Version\
    Winlogon
Value: LegalNoticeText (REG_SZ):
  Your message box text
```




**Some simple precautions can prevent unauthorized access to your system through Internet connections.**

Another log-on adjustment you should make is to stop NT from displaying, in the log-on dialog box, the name of the last user who logged in. This reveals a valid user name to would-be intruders. To hide the last user's name, set the following registry key to 1 (use the C2 configuration utility in the NT Resource Kit):

```
HKEY_LOCAL_MACHINE\Software\
  Microsoft\WindowsNT\
    CurrentVersion\WinLogon\
      DontDisplayLastUserName
```


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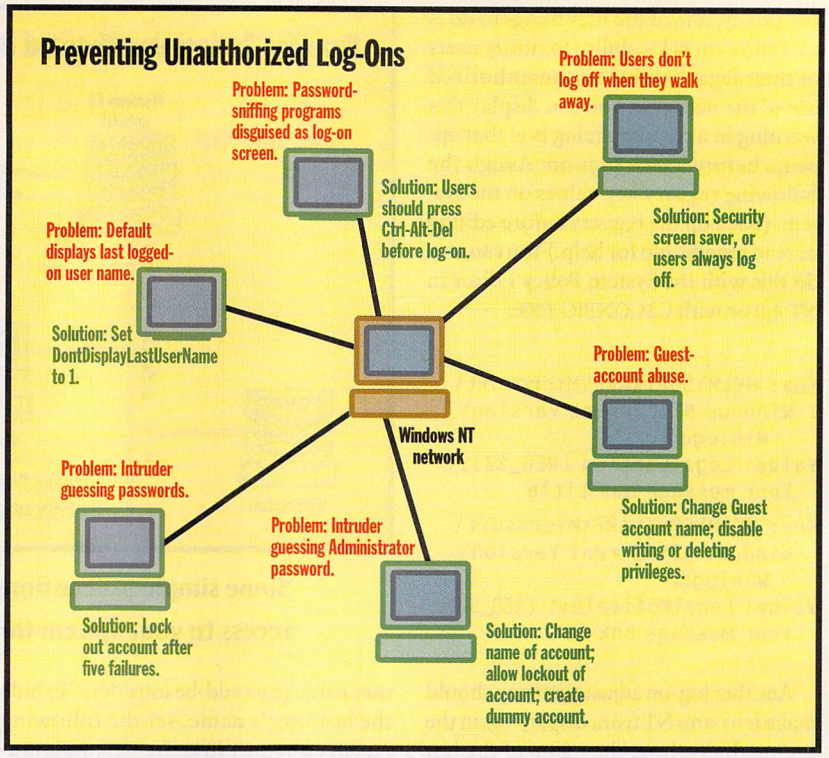
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Make sure that users know to always press Ctrl-Alt-Del before logging on. This gives the secure log-on screen provided by NT, which helps defeat password-sniffing programs disguised as waiting log-on screens. Users should also log off or lock their workstation whenever they go away from it. Logging off is more secure because a password is required to log back on. For automatic locking, you can enable a password-protected 32-bit screen saver with a low time-out value.

Deter brute-force password-guessing attacks by using NT's User Manager to set an account-lockout policy. Such a policy might specify that NT will lock out an account after five failed log-on attempts.




**Some underused Windows NT security features can keep unauthorized users from logging on to your system.**

## Policy and Policing

Another key issue: Administrators should log off from domain controllers as soon as they complete administrative tasks. (NBTSTAT.EXE can determine the name of any user logged on to an NT system, even an administrator on a domain controller.) Consider doing administrative tasks remotely from another NT system.

Don't use administrator accounts for doing general work. Make sure that users who need administrative privileges also have—and use—a separate account for all nonadministrative work. This helps avoid accidental changes to protected resources. Minimize the number of users that have administrator privileges.

Change the name of the built-in Administrator account to something less obvious (using User Rename in User Manager). This account is a target for interlopers attempting entry by guessing passwords, because it's not locked out by failed log-on attempts. By renaming it,

## A Dozen NT Security Resources

- Check **http://www.microsoft.com/security/** regularly and click on the Windows NT link in the "Information by Product" section. Read the white paper titled "Securing Windows NT Installation."
- Review the Coopers and Lybrand white paper on Windows NT security for useful descriptions of the NT security internals, along with discussions of various other issues (available at **http://www.microsoft.com/ntserver/guide/cooperswp.asp**).
- Join the relevant security mailing lists. Internet Security Systems has done the world a favor by gathering a bunch of list info at **http://www.iss.net/vd/maillist.html**. ISS also hosts several lists, including one called NT Security, a must-read for NT security administrators.
- Try Kane Security Analyst (KSA) for Windows NT, available at **http://www.intrusiondetection.com**, a tool for determining and auditing the configurations of multiple systems on a recurring basis.
- Try Internet Security Scanner (ISS), available at **http://www.iss.net**, an excellent tool for evaluating TCP/IP-based systems, including Windows NT, as well as firewalls and Web servers.
- Try Ballista, available at **http://www.secnet.com**, a new tool for evaluating TCP/IP-based systems. Secure Networks, the authors of Ballista, focus on NT issues for this and other products.
- Visit Somarsoft, at **http://www.somarsoft.com**, for its DumpAcl application and other tools useful for securing file systems and the registry, as well as its NT-security white paper.
- Check out the tools available at **http://www.securityserver.com/category/@winnt5.htm**.
- Check out the detailed analysis of password-cracking issues, relative to reports of Windows NT password hacking, at **http://www.osp.nl/infobase/ntpass.html**.
- Use the C2CONFIG.EXE program, which comes with the NT Resource Kit, to adjust security settings.
- Check out the updated list of NT vulnerabilities, available at **http://www.infilsec.com**.
- The following titles provide an overall understanding of NT security, within which to fit the assorted tips and tricks provided on the Web:

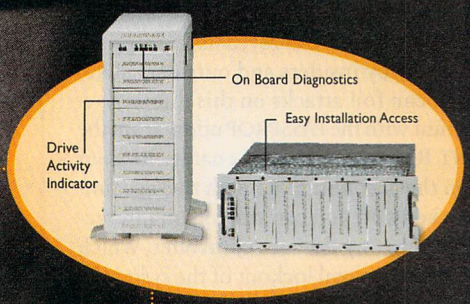
***Windows NT Security: A Practical Guide to Securing Windows NT Servers and Workstations*** by Charles B. Rutstein (McGraw-Hill, 1997, $34.95).

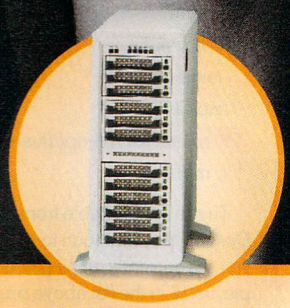
***Windows NT Security Handbook*** by Tom Sheldon (Osborne McGraw-Hill, 1996, $34.99).

***Windows NT Security Guide*** by Stephen A. Sutton (Addison-Wesley, 1996, $29.95).

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you force attackers to guess the name as well as the password.

You can create and maintain a dummy account with low privileges and call it "Administrator" to monitor for attempted access. This can reveal inappropriate activity by insiders and outsiders alike. You can foil attacks on this dummy account with the PASSPROP utility from the NT Resource Kit. This enables lockout on the account. Even with this account locked out, you can still log on interactively to any domain controller, which prevents a total lockout of the system.

In addition, you should prohibit use of the Guest account for writing or deleting files, directories, or registry keys (with the possible exception of a separate Guest directory). Remove the built-in Guest account (using C2CONFIG.EXE) and create a limited-access one with a nonobvious name (e.g., Joe Higgins, not Visitor).

Next comes auditing, which is vital for policing NT networks. Audit all failed and successful security events, such as log-in and log-off attempts, file and object access, account management, security-policy changes, restart and shutdown, and process tracking. Do this via User Manager; the Policies Audit selection leads to a screen for auditable events. Microsoft's site discusses recommended audit settings (see the text box "A Dozen NT Security Resources" on page 88F).

Whatever choices you make, be sure to do two things with the audit logs: Check them and protect them. There's no point in auditing if you don't review the logs. Regular review, especially of security events, is vital. If you don't back up logs to a secure location, an intruder could alter them to cover his or her tracks.

Establish new users correctly. NT's user/group architecture allows extremely granular user access. Deny a user all access except that which is explicitly allowed to him or her. Brief new users and update current ones. Users must understand acceptable-use policy, password guidelines, and general security issues.

When a person leaves an organization or changes roles, you must immediately update or remove access information and accounts. In addition, periodically check for, and disable, inactive accounts.

Finally, check regularly that you use all of NT's password features, including password strength, length, and freshness. Also check trust relationships to ensure users are abiding by your security policy.

## NT 4.0 Patches

To close up known security holes in Windows NT 4.0 Server, you need to install the latest OS "patches." Microsoft periodically supplies these in the form of Service Packs, or SPs. Between SP releases, there are hot fixes. The last SP was SP3. Until SP4 becomes available, you need to install the following multiple hot fixes (and in the order shown, to ensure that a newer fix is not replaced by an older one).

| | | |
|---|---|---|
| 1. oob-fix | 12. getadmin-fix | 23. SAG-fix |
| 2. asp-fix | 13. winsupd-fix | 24. iis4-fix |
| 3. java-fix | 14. ndis-fix | 25. pptp-fix |
| 4. dns-fix | 15. scsi-fix | 26. teardrop2-fix |
| 5. iis-fix | 16. 2gcrash | 27. tapi21-fix |
| 6. lsa-fix | 17. simptcp-fix | 28. pcm-fix |
| 7. dblclick-fix | 18. ide-fix | 29. srv-fix |
| 8. icmp-fix | 19. wan-fix | 30. y2k-fix |
| 9. zip-fix | 20. land-fix | 31. euro-fix |
| 10. roll-up (or roll-up/cluster) | 21. pent-fix (x86 only) | 32. atapi-fix |
| 11. mdl-fix | 22. joystick-fix (x86 only) | 33. netbt-fix |

These are available from **ftp.microsoft.com/bussys/winnt/winnt-public/fixes**. Do NOT pay attention to Microsoft's recommendation to "wait for Service Pack 4 unless you are currently running into a specific problem resolved by one of these fixes." For example, fix 26 in the list above protects against the so-called teardrop attack. With the above message, Microsoft appears to be suggesting that you wait until you've suffered from this attack before installing the cumulative set of fixes that protect you from it. For tips on installing multiple hot fixes, see **http://www.jsiinc.com/reghack10.htm#T191**.

(List courtesy of Chey Cobb, CISSP, Information Security Officer, Attorneys' Title Insurance Fund)

## Creating Security

The creation of secure implementations of NT is a multistage process. First, an organization must define a security policy. Next, it must evaluate system configurations and update them to comply with policy. Finally, it must regularly review systems to ensure continued compliance.

Several tools can assist organizations in testing their NT configurations. For example, Intrusion Detection's Kane Security Analyst (KSA) for NT can help audit configurations of multiple systems periodically. Internet Security Systems' Internet Security Scanner and Secure Networks' Ballista are useful for evaluating TCP/IP-based systems, including NT, as well as firewalls and Web servers.

Just as user-access requirements for a system change, overall security requirements can change, too. You should regularly review not only compliance with policy, but the policy itself. We've seen rapid changes in the security posture of NT, as well as more knowledge in the hacker and research community.

Finally, prepare to respond to security violations. If a tool such as KSA is available, use its digital-signature features to ensure that system files don't get altered. System and security logs show the level of compromise. Tools such as DumpACL, from Somarsoft, can ensure the integrity of security settings and access control. If a violation is at the administrator level and system integrity is not ensured, reinstall your system from a CD-ROM.

The increasing popularity of NT makes it a more popular target. Using its security features can keep you ahead. B

### WHERE TO FIND

**Internet Security Systems**
Atlanta, GA
800-776-2362
770-395-0150
http://www.iss.net

**Intrusion Detection**
New York, NY
800-408-6104
212-348-8900
http://www.intrusion.com

**Secure Networks**
Calgary, Alberta, Canada
403-262-9211
http://www.securenetworks.com

*Stephen Cobb, a Certified Information System Security Professional, is director of education and research at Miora Systems Consulting (Titusville, FL). David Brussin, a Microsoft Certified Professional, is director of MSC Labs and a senior consultant at Miora. You can reach them at* **scobb@miora.com** *and* **dbrussin@miora.com**, *respectively.*

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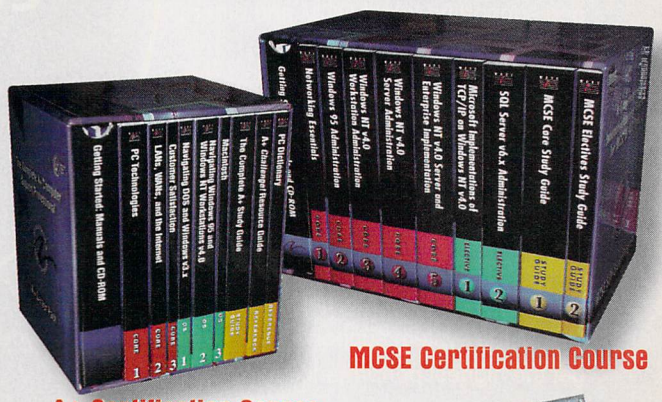
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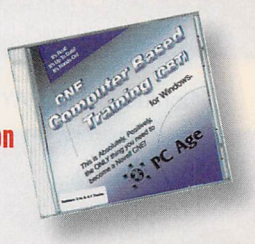
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*ESD lets anyone offer software on-line, simply, quickly, and economically.* ***By Sam Masud***

# Selling Bits with Electronic Software Distribution

Since the mid-80s, BBSes have been offering shareware, but nobody ever knew who would be using it or whether the user had any intention of paying for it. As the popularity of the Web increased, so did the popularity of on-line distribution of demoware—time- or feature-limited software. Unfortunately, it does not follow that shareware and demoware translate into increased sales. "As late as 18 months ago there was a lot of distribution of software going on over the Internet but little commerce," says Jay Moore, manager of Netscape Software Depot, an on-line store that sells packages from companies that aren't Netscape competitors.

That's where electronic software distribution (ESD) comes in. ESD holds the promise of providing vendors with 100 percent user registration and payment while continuing to offer customers the instant software accessibility they crave. Little wonder that major software publishers like Microsoft and Symantec are enthusiastic about ESD. Not only does it ensure payment and registration, but it also delivers the product to the end user faster, either directly from a company's own Web site or through the channel. Consequently, Web sites are morphing from a simple shingle on the Internet to full-fledged ESD stores. Symantec Café, a Java development tool, became the first ESD-ready product for sale in Symantec's Web shop (*http://shop.symantec.com*) in June 1996, and a year later the company added Norton AntiVirus to its electronic shelf.

Today's downloadable software is typically lightweight: mostly single applications, utilities, patches, plug-ins, and upgrades. You don't find major operating systems and full software suites ready for downloading. Delivery of larger software packages is hampered not just by the typical user's limited dial-up bandwidth, but by the Internet itself. "The minute you get past 20 MB or 30 MB, the product gets difficult to download," concedes Bill Holtzman, vice president of marketing for on-line provider software.net. (Arguably the largest on-line reseller of Java software, software.net is also manager of Netscape Software Depot.)

This article will look at the technologies and products working for—and against—this new method of getting software into the hands of customers.



**"I can't afford to fork over the money for a large inventory, but now I can sell products that I didn't carry in my store."**

**—Troy Schnack, general manager, Beyond Bytes**

PHOTOGRAPH: KEITH PHILPOTT © 1998

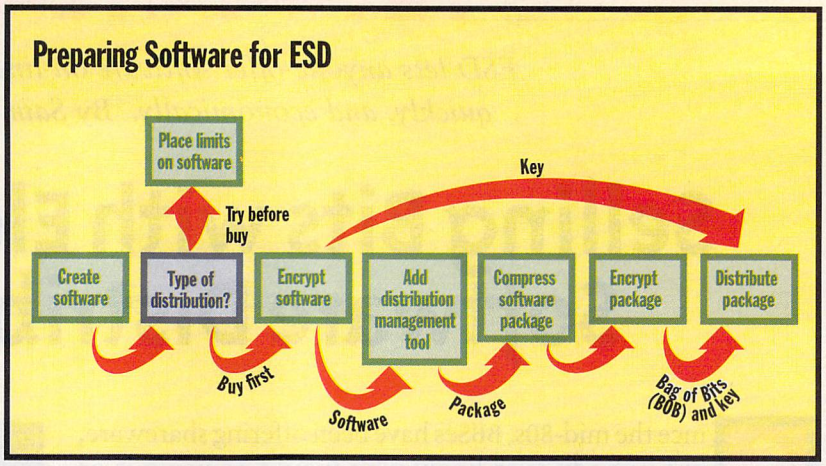
## Virtual Floorspace

No inventory. Almost unlimited selection. Round-the-clock service. Instant payment. Low overhead. These are what enticed one VAR, Beyond Bytes (Independence, MO), into ESD.

Beyond Bytes is doubling its physical store to 6000 square feet, a third dedicated to retail show space. Yet even with the expansion, general manager Troy Schnack couldn't offer the more than 50,000 items available from his Web store.

Beyond Bytes was a traditional VAR specializing in customized servers and business-grade accounting packages. The on-line version of the store allows Beyond Bytes to provide software and hardware that it couldn't have carried in inventory. "We have always been restricted to the high-end products. Everything from retail software to consumer lines offered by Compaq and others are generally not made available to the VAR," says Schnack.

Now about half of his on-line store is software, from children's games to personal tax packages. Moreover, because several dozen of those titles are immediately downloadable, the buyer doesn't have to wait for boxes to arrive days after the purchase. As Schnack notes, "I can't afford to fork over the money for a large inventory, but now I can sell products that I didn't carry in my store."




**Software needs encryption, compression, and distribution management before it's ready for ESD.**

On-line stores can be especially useful to small resellers and ISVs. Compared to getting shelf space at a major computer store, ESD provides a low cost outlet for bringing products before buyers.

Atlanta-based Xtras, for instance, has been a reseller of Visual Basic development tools and server administration tools for over four years. "We bring on anything for VB developers, but don't try to ascertain whether there's a market for the product," says Xtras president Mike Schinkel. "Some products may have a worldwide market for just 10 copies." Packages on Xtras' Web site cost between $100 and $500. "The ones that do well are priced between $100 to $300. Anything over $500 doesn't sell well in our channel," says Schinkel.

## You Can, Too

ESD is a young industry and even the companies that provide the technology are pursuing different business models that they hope will lead them to long run success with the publishers.

Turnkey ESD vendors such as Release Software, NetSales, and BITSource can set up ESD-ready Web shops that you run. Alternately, full-service providers like eWarehouse can provide you with a complete set of services to sell from your Web site. Likewise, software.net is finalizing an affiliates program. Under this program you would put a "Buy It" button on your Web site, and people clicking on that button would transparently arrive at software.net. In return for bringing in the business, software.net would work out a repayment scheme with you.

Before you can deliver any software on-line profitably, you need a mechanism to guarantee payment and registration. To ensure this happens, you must encrypt the software and compress it into a package known as a Bag of Bits (BOB). This process, which usually takes a few minutes, requires a special application known as a wrapper. The software publisher decides whether to create the BOB itself or farm out the work to a distributor or some neutral party.

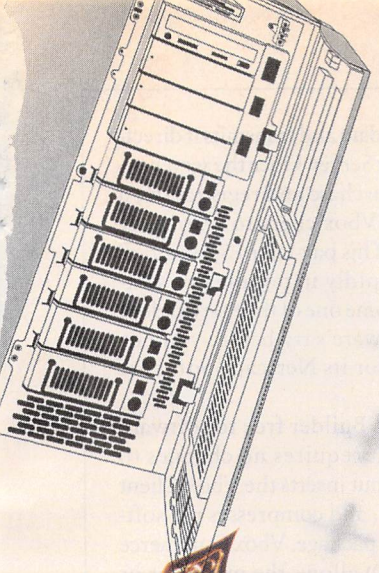
## A SCMP of a Standard

Eventually there will be a standard for almost anything that happens on the Internet. ESD is no exception. If the role of the clearinghouse remains central to ESD, then it is likely that some variation of the Simple Commerce Messaging Protocol (SCMP), developed by CyberSource, may soon become an Internet standard. Formed a year ago, the ESD Messaging and Protocol (EMAP) working group plans to submit SCMP to the Internet Engineering Task Force as a general-purpose commerce transport protocol.

In a multitier channel, SCMP enables secure communications between the Web merchant's commerce server and the clearinghouse. This, in effect, gives the merchant a way to take advantage of various clearinghouse services such as delivery of the product and the unlock key, payment processing, fraud screening, and sales-tax calculation. For instance, for merchants using Microsoft Site Server 2.0, CyberSource provides the Digital Commerce Component, which is a Microsoft Commerce Server Component Object Model that plugs into the server's order processing pipeline.

Unlike the more detailed Secure Electronic Transaction protocol (sponsored by Visa), which specifies the payload, the SCMP draft specification purposely does not say anything about the payload or content of messages. The proposed SCMP does, however, require identifying the payload to the receiving server using a naming convention similar to that used by the Multipurpose Internet Mail Extension (MIME).

The draft SCMP also specifies signing, encrypting, and re-signing the payload—or triple wrapping. Experts consider triple wrapping necessary in order for an intermediary system such as a gateway server or a message router to be able to process the outer signature and yet maintain the integrity of the content. At the same time, however, the proposed standard provides some flexibility by allow trading partners to exchange clear data so long as it is signed.



# THE SERVER QUIZ....
## or "How to tell if you're a data slave"

Circle the best answer to the following:

1. **My cubicle is more comfortable than:**
   a) a prison cell
   b) a cold toilet seat
   c) my home

2. **My spouse would be happier if I were:**
   a) rich
   b) better looking
   c) a long haul trucker so I could spend more time at home

3. **My server maintenance routine often involves:**
   a) backups
   b) diagnostics
   c) offerings to the gods.

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Portland Software, founded a little over four years ago, is the acknowledged granddaddy of the wrapper biz. Its ZipLock solution, at $30,000, has three parts: Builder, Merchant, and Server. The Builder converts software into a compressed, encrypted BOB that may include publisher information. During this process, ZipLock Server registers the BOB and assigns it a product ID to keep track of it. The server records transaction information and, after delivery of the product to the customer, provides a digital key to decrypt the software before the buyer can install it. In some delivery systems, you e-mail the key to the user. In other systems, such as ZipLock, the server delivers the key to the user's ESD interface—the customer never even sees it.

As a reseller, you would use the ZipLock Merchant to create marketing, service, promotional, and pricing information for each product, in effect allowing you to brand the product. A good system will let you change this information between one transaction and the next. The ZipLock system ensures that the end user doesn't have a working piece of software until after payment has been approved. Thus it offers the publisher, distributor, and reseller a strong chance of getting paid for each download. Since ZipLock supports a pay-first model, however, the downside is that vendors risk unhappy customers who bought the software and then decide they don't like it.

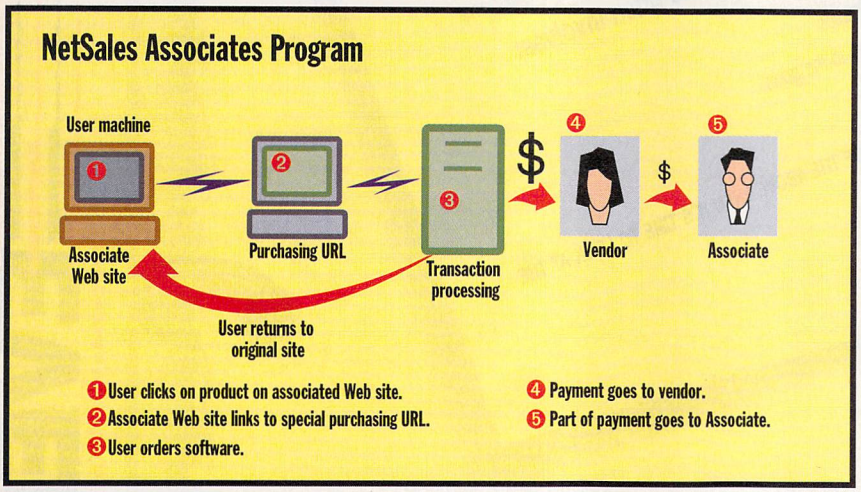
The customer can get refunds, of course. The end user typically would send e-mail to the reseller. The reseller would then use its component of the ESD system to process the return and invalidate the end-user's license on the server. As with any credit card transaction, the end user would see the purchase amount credited on her monthly credit card bill.

On a different tack from Portland Software, Preview Software offers a try-before-you-buy solution. Its Vbox system lets the developer create a time bomb—a full or feature-limited edition of the software that "self-destructs" after a given period. In effect, this gives the user a chance to try the product before actually paying for it. The publisher can define trial periods based on number of days since installation or first use, number of executions, or number of hours used. It can also expire on a certain calendar date. In the future, Preview Software plans to add other options that would allow you to distribute software on a rental or pay-per-use basis as well.

The Vbox client is persistent, meaning it does not self-destruct but stays with the application after download, installation, and purchase. It warns users that the software is available only on trial during the specified trial period, and offers a "Buy It" button that lets the user complete the purchase transaction on-line. It shrewdly continues to give the user a chance to buy the application even after the trial period is over. The client interface also has forms for filling in user name, credit card, and other billing information. It encrypts this data and transmits it directly to the Vbox Server. Once the server approves the purchase and registration, it instructs the Vbox client to unlock the application. This pay-later ESD solution is gaining rapidly in popularity. software.net became one of the first to adopt Preview Software's try-before-you-buy technology for its Netscape Software Depot.

Vbox gives Builder free to software publishers. It requires no changes to source code, but inserts the Vbox Client as it encrypts, and compresses the software into one package. Vbox Commerce Builder ($300) allows the publisher or reseller to add branding information—such as price, telephone number, and e-mail address—to the package.

A powerful alliance already has arisen with the recent merger of Portland Software and Preview Software. The merger is not surprising because earlier this year the two agreed to combine their technologies to allow Preview's client to work with Portland's server. Preview is expected to offer a client compatible with Portland's server this month.




**NetSales' Associates program lets Web sites feed orders into a central ordering site; a percentage of sales go to the associate's site.**

## Third Parties

The clearinghouse is the other major player in this business, although its future is uncertain. A concept that Microsoft has pushed, and the Software Publishers Association has supported, the clearinghouse is to be a trusted third party watching ESD transactions between the distributor, reseller, and customer. The clearinghouse delivers the unlock key to the end-user and reports all transactions to the software publisher as well as the distributor and reseller. CyberSource and OrderTrust (formerly LitleNet LLC) were the first two clearinghouses Microsoft picked to distribute its software.

A company like CyberSource does more than deliver keys and report transactions. It also provides other back-office services such as screening for fraudulent credit, credit card transaction processing, and order fulfillment. CyberSource also can provide the wrapper for the BOB, using either its own SmartCert X.509-standard technology or a third-party wrapper from Portland Software, Preview Software, or others. software.net, a part of CyberSource until it went independent in April, uses CyberSource to do the wrap for the software titles it owns.

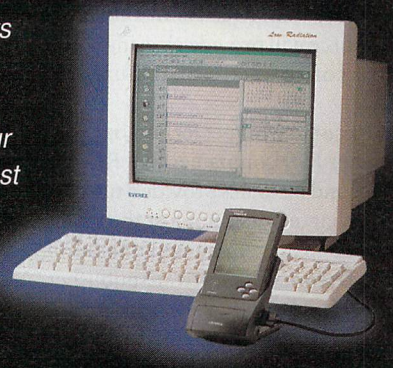
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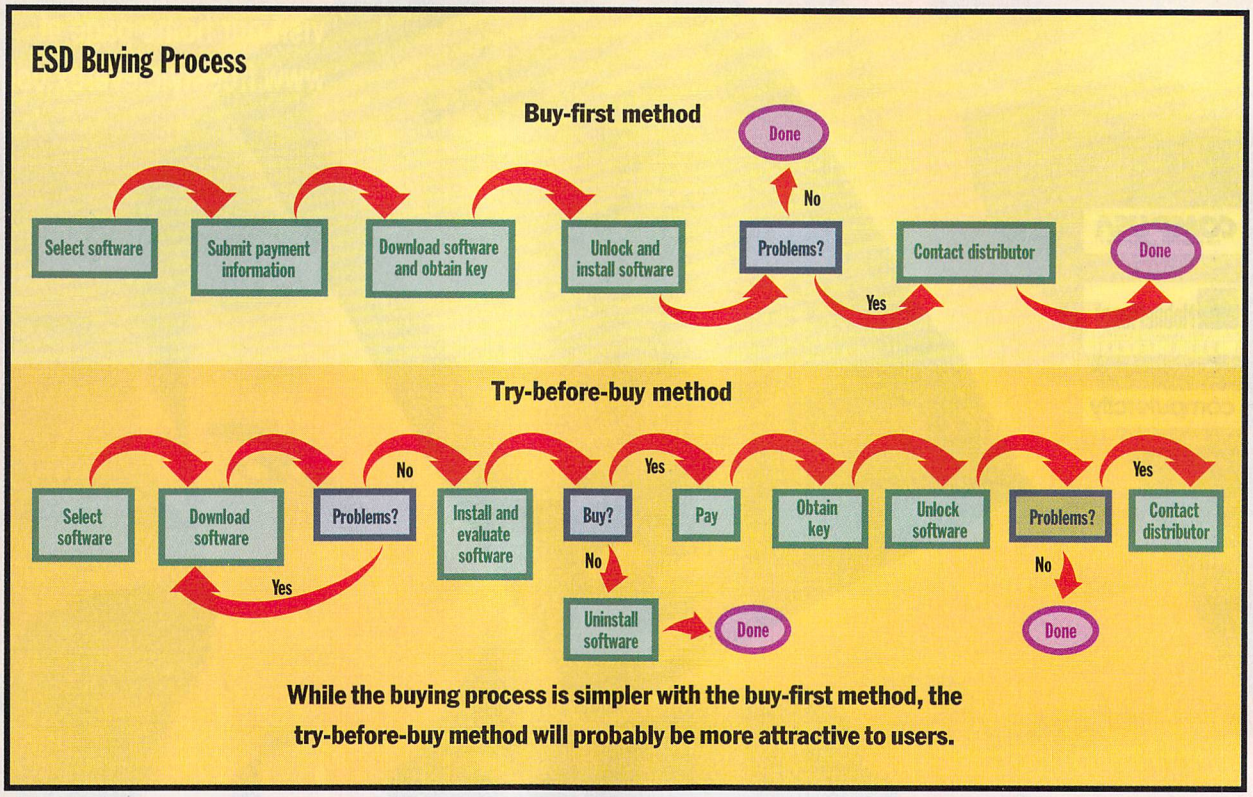
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**While the buying process is simpler with the buy-first method, the try-before-buy method will probably be more attractive to users.**

acts as a digital warehouse for its customers. The Registry manages the services that ensure that licenses and keys are issued properly, and provides an accounting of all transactions to the owner of the software and any reseller channel involved. The system has its own Simple Commerce Messaging Protocol (SCMP) for messaging. Several wrapper technologies, including those from Portland, Preview, BITSource, and TestDrive, support SCMP (see "A SCMP of a Standard," page 88L). Some companies even place their ESD servers behind CyberSource's firewall. Distributor Tech Data currently uses CyberSource as a clearinghouse for Microsoft, IBM, and Lotus products sold through resellers like Programmer's Paradise. Through a similar pact with Merisel in February, CyberSource will provide clearinghouse services for software distributed by Merisel.

In contrast to wrapper technology vendors, other ESD companies like Release Software and NetSales provide a turnkey solution that includes not just the wrapper but the management and operation of the ESD store. The software publisher must decide whether to use an independent clearinghouse or the in-house services of Release Software or NetSales. Release Software (which incidentally operates BYTE Magazine's on-line store) supports both the try-before-you-buy and pay-first methods by offering two different versions of its SalesAgent technology. The publisher can choose try-before-you-buy for software during a specified trial period or to turn off certain features until the customer pays for it.

"It takes about 48 hours to build a cyberstore for a VAR that can carry the entire inventory of a distributor," says Robert E. Fraser, president and chief executive officer of NetSales, which built Beyond Bytes's on-line store. The store integrates seamlessly with Beyond Bytes's Web site so that prospective buyers who click on a button connect to the on-line store. "Our reach has broadened dramatically," says Beyond Bytes' Schnack. "With ESD, we can reach those home, home office, and corporate contacts by name recognition when they purchase products from us on-line rather than from the local superstore. This gives us the added advantage of a contact in organizations who otherwise may not know of our company and its services."

BITSource's SmartShelf approaches ESD somewhat differently from others: The VAR or corporate customer has the option of keeping encrypted titles locally on a fulfillment machine. Only the decrypt key obtained from the clearinghouse travels over the Internet. The fulfillment machine can complete the transaction by installing the decrypted software on the user's hard disk or burning it into a CD. SmartShelf provides resellers with the administrative controls to set customer-specific credit limits and prices, control system-access privileges, and ensure that only authorized personnel will fulfill orders. More importantly, the SmartShelf system may be one of the very few that can provide volume licenses to the corporate customer, letting them first explore available discount options and then delivering the license. The technology is still relatively new: BITSource's first on-line volume license, a 300-seat order for Symantec's WinFax Pro software, was delivered at the end of 1997. Nevertheless, in the future, systems like SmartShelf could provide a level of comfort for the corporate buyer.

## A Whole Future Ahead

*In the future*, however, remains the operative phrase. True electronic software distribution is still relatively rare, particularly in the corporate sector. "We use our T1 line for downloading shareware and patches, but the only e-commerce I'm

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doing is with vendors who provide on-line ordering of hardware," says John Van Nice, director of information services for Allen Press (Lawrence, KS), publisher of scientific and medical journals. "I don't buy software on-line. That I get from resellers with whom we've got an open account." Van Nice, however, believes ESD will catch on because "everybody is looking at convenience."

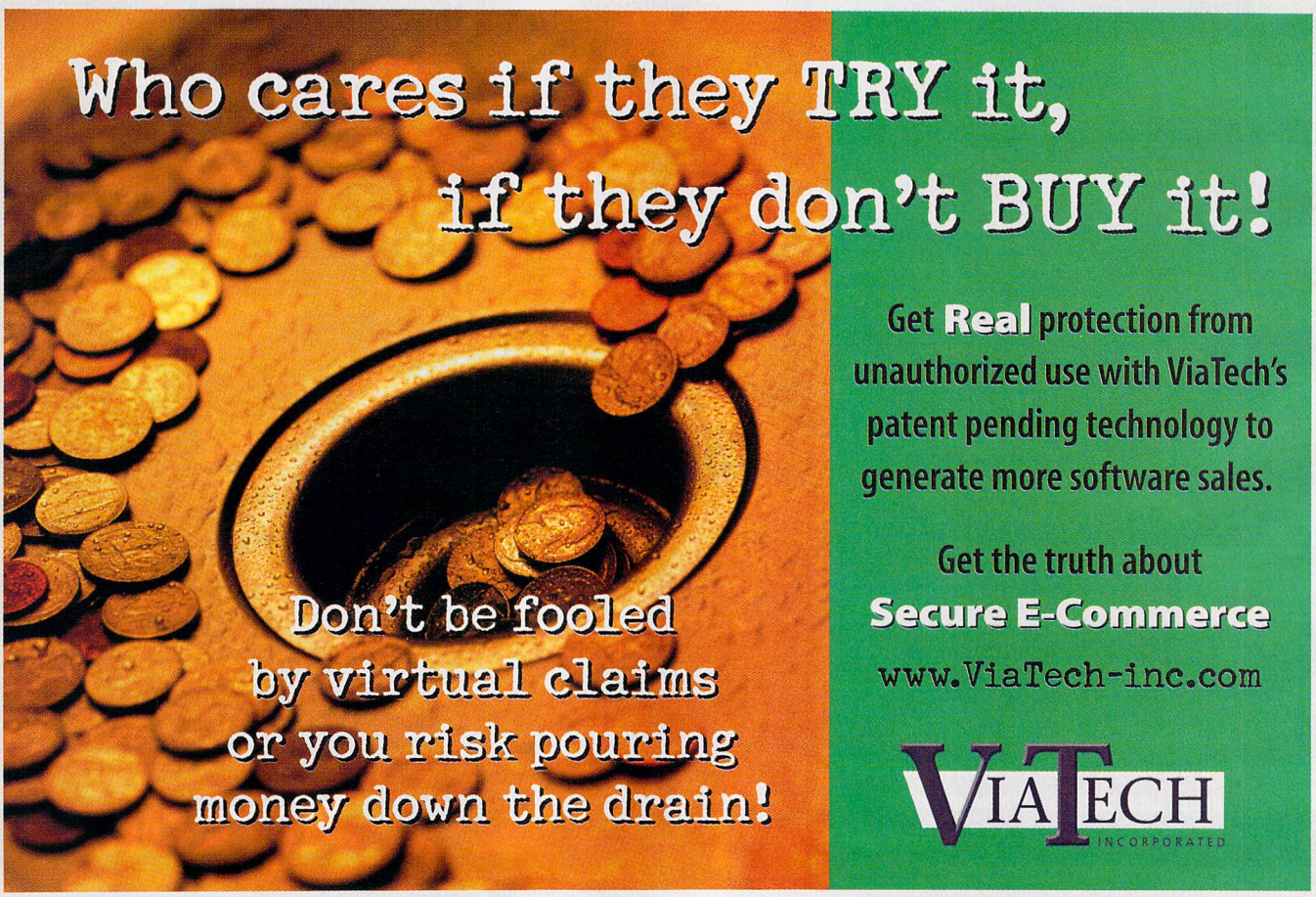
Bandwidth, says Chris Stevens, senior analyst with the Aberdeen Group, is not a paralyzing issue for ESD—even though at 21.1 MB Norton Utilities can take almost two hours to download. "The ESD market hasn't taken off as much as the players would like it to," says Stevens, faulting the industry for focusing more on the technology than the buying process. "Instead of focusing on making bulletproof containers, they should focus on making sure that buying on-line is easier than off-line. For instance, the back-end system should support someone who bought software two weeks ago, had it blow up, and now needs a new copy.

Although Web stores like software.net and eWarehouse offer upwards of 30,000 titles each, you can download only a small number of those immediately via ESD. Microsoft, expected to open its on-line store later this summer, has about 200 software products, besides upgrades or new versions, but only about 65 of them are ESD-ready. Nonetheless, almost everyone is bullish about the future of ESD. International Data Group predicts sales from ESD will jump from $250 million in 1996 to $4.6 billion by the year 2000. In a 1996 survey of 310 PC software companies by *Softletter*, 89 percent of the respondents predicted that a third of their revenue could come from ESD sales by the year 2000.

Microsoft's own plans for an on-line store for its products could give ESD the boost it needs. "It's the chicken-or-the-egg situation," says Neal Farnsworth, general manager for business development in Microsoft's consumer unit. "There's not enough volume for the clearinghouse to do the wrapping of the products, yet there are not enough products wrapped to jumpstart the ESD revenue stream."

Microsoft plans to test a "Buy Now" feature of its store this summer; the enterprise could open for business by fall. The store will support software rental in addition to try-before-you-buy. Microsoft will likely use its own wrapper technology, codeveloped with a third party, while having a clearinghouse supply credit card verification and fraud screening services. So even though a reseller site might sell the software, the key would have to come from Microsoft rather than the clearinghouse. Developing its own wrapper, says Microsoft, will limit the chances of problems with electronically packaged goods. "Our products go through quality assurance, but when you're creating an ESD SKU [stock keeping unit], that requires some work, and some wrappers—like the try-before-you-buy wrapper—may require changes in the source code," says Farnsworth.

Despite having its own ESD store, Microsoft says it will keep supporting the two-tier channel. Notices in its on-line

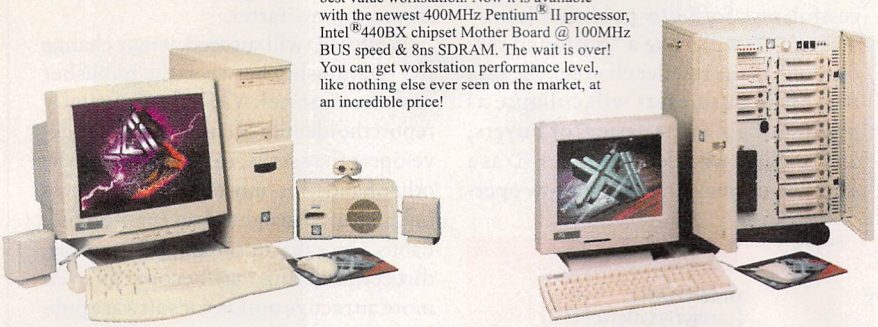





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store will clearly advise prospective buyers that the store's products are priced higher than resellers' are, and the company promises to refer buyers to resellers. "ESD won't be *the* way for selling software, but will be an alternative method. And I think that a lot of existing partners, people who are playing in the traditional market, will move to ESD," says Farnsworth.

More ESD-enabled Web stores also means more competition. Symantec currently has about 500 value-added resellers doing business on the Web—though not all are using ESD—and wants to have as many as 5000 points of sale on the channel by the end of the year. If successful, says *Softletter* publisher Jeffrey Tarter, ESD will make a "profound revolution" in the reseller channel. He says that some businesses will collapse as price shopping gets easier for buyers, and resellers who decide to use ESD as a sales avenue may find they're now operating not one expanded business but two. Many traditional brick-and-mortar resellers will find this hard to do. "You don't see amazon.com [the large on-line bookshop] opening bookstores," notes Tarter.

While ESD will succeed, it may change the relationship between the publisher and the channel. VARs don't usually report the identity of customers to the developers they serve. ESD systems, on the other hand, not only identify customers but also give insights into their buying habits. Once that information is available, direct marketing may become an even more attractive option for software publishers. Strangers to a new environment, all participants in the on-line store space, will be looking to make the most of what could be a promising industry. For the reseller, ESD presents an opportunity as well as a challenge to the traditional way of doing business. B

*Sam Masud is a freelance writer covering the computer/communications industry since 1979. Reach him at* **smasud@mediaone.net.**

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SyJet 1.5GB SCSI external PC/Mac ..... 299.99

Quantum

Viking II 4.5GB Ultra2 SCSI ..... 469.12
Atlas III 9.1GB Ultra2 SCSI ..... 859.63
Fireball SE 4.3GB Ultra ATA ..... 194.78
Fireball SE 6.4GB Ultra SCSI-3 ..... 375.70

2.1GB IDE ..... 129.84
2.55GB IDE ..... 139.82
4.5GB Ultra SCSI ..... 589.03

## INPUT DEVICES

Cross iPen ..... 109.48
Kensington Mouse-in-a Box ..... 19.99
Kensington Orbit ..... 56.93
Kensington Expert Mouse V5.0 PS/2 ..... 95.71
Logitech MouseMan Plus ..... 49.93
Logitech Trackman Marble ..... 55.28
Microsoft SideWinder Precision Pro joystick ..... 55.67
Microsoft Natural Keyboard Elite ..... 58.84
Microsoft IntelliMouse V3.0 ..... 56.94
Microsoft IntelliMouse TrackBall ..... 71.44

## DIGITAL IMAGING

Agfa ePhoto 780 digital camera ..... 489.25
Agfa ePhoto 1280 digital camera ..... 739.27
Epson PhotoPC 550 digital camera ..... 299.00
Epson PhotoPC 600 XGA digital camera ..... 499.00
Hewlett-Packard PhotoSmart C20 digital camera ..... 699.00
Kodak DC120 Zoom digital camera ..... 699.00
Kodak DC210 Zoom digital camera ..... 699.00
Microtek EyeStar videoconferencing camera .98.94
Minolta Dimage PIC digital camera ..... 309.45
Minolta Dimage V digital camera ..... 399.28
Nikon Coolpix 300 digital camera ..... 395.28
Olympus D-500L digital camera ..... 799.00
Olympus D-600L digital camera ..... 1299.00
Ricoh Zipshot digital camera ..... 129.00
Ricoh RDC-300 digital camera ..... 399.00

## SCANNERS

Epson Expression 636 Exec ..... 799.00
Epson Expression 836XL ..... 2499.00
Hewlett-Packard PhotoSmart photo scanner ..... 399.00
Hewlett Packard ScanJet 5s scanner ..... 199.28
Hewlett Packard ScanJet 5100Cse scanner .299.00
Hewlett Packard ScanJet 6100Cse scanner .799.00
Microtek Color PageWiz ..... 157.28
Microtek ScanMaker E3 Plus ..... 124.51
Microtek ScanMaker E6 standard ..... 279.43
Minolta Dimage Scan Dual ..... 574.36
UMAX Astra 610S ..... 129.00
UMAX Astra 1200S w/Photoshop LE ..... 299.00
UMAX Mirage IIse w/MagicScan ..... 2995.00
Visioneer PaperPort mx ..... 98.20
Visioneer PaperPort 3100 flatbed ..... 149.33
Visioneer PaperPort 6000B flatbed ..... 196.06
Visioneer PaperPort Strobe ..... 249.99

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BJC7004 ..... 349.00
MultiPASS C5000 print/scan/copy/fax ..... 499.00

EPSON®

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Stylus Color 800 ..... 299.00
Stylus Color 850 ..... 379.00
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Stylus Photo 700 ..... 279.00
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HP LaserJet 6Pse printer ..... 799.00
HP LaserJet 4000se printer ..... 1149.00
HP LaserJet 8000 printer ..... 2438.03
HP Color LaserJet 5 printer ..... 3939.21
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LEXMARK

Color Jetprinter 1000 ..... 139.02
Color Jetprinter 5700 ..... 244.38
Optra E+ ..... 388.13
Optra S 1255 ..... 939.88
Optra S 1625 ..... 1009.80
Optra S 1855 ..... 1104.14
Optra S 2455 ..... 2049.58
Optra SC 1275 ..... 2946.63

OKIDATA

OkiJet 2020 ..... 199.00
Okipage 4w ..... 199.00
Okipage 6e ..... 299.00
Okipage 16n ..... 899.00
Okipage 10i ..... 599.00

## MONITORS

MAG InnoVision 410V2 14" (13.3" view) 0.28mm ..... 139.64
MAG InnoVision DJ530 15" (13.9" view) 0.28mm ..... 199.92
MAG InnoVision DJ700 17" (16.1" view) 0.26mm ..... 395.79
MAG InnoVision DJ800 19" (18" view) 0.26mm ..... 586.36
NEC MultiSync A500 15" (13.8" view) 0.25mm ..... 269.61
NEC MultiSync A700 17" (15.6" view) 0.25mm ..... 477.63

## MONITORS

NEC MultiSync E1100 21" (19.8" view) 0.28mm ..... 1059.90
NEC MultiSync LCD400 14.1" flat panel LCD ..... 1899.00
Philips Magnavox 104B 14" (13.4" view) 0.28mm ..... 169.22
Philips Magnavox 105S 15" (13.8" view) 0.28mm ..... 187.34
Philips Magnavox 107S 17" (15.9" view) 0.28mm ..... 347.30
Princeton E050 15" (13.8" view) 0.28mm ..... 215.91
Princeton E070 17" (15.8" view) 0.28mm ..... 339.92
Princeton E090 19" (18" view) 0.26mm ..... 666.39
Sony Multiscan 100ES 15" (14" view) 0.25mm ..... 297.43
Sony Multiscan 200ES 17" (16" view) 0.25mm ..... 539.53
Sony Multiscan 400PS 19" (18" view) 0.25-0.27mm ..... 949.63
ViewSonic E771 17" (16" view) 0.27mm ..... 384.62
ViewSonic G653 15" (13.8 view) 0.28mm ..... 249.06
ViewSonic G773 17" (16" view) 0.26mm ..... 459.84
ViewSonic GA771 17" (16" view) 0.27mm w/spkrs ..... 517.07
ViewSonic GS771 17" (16" view) 0.27mm ..... 449.65
ViewSonic G790 19" (18" view) 0.26mm ..... 777.72
ViewSonic P815 21" (20" view) 0.25mm ..... 1237.87
ViewSonic VPA138 ViewPanel 13.8" active LCD ..... 936.46
ViewSonic VPA150 ViewPanel 15" active LCD ..... 1347.42

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3Com Ethernet adapter w/XJACK ..... 107.80
3Com 32-bit Fast EtherLink XL CardBus ..... 147.57
3Com LAN PC Card combo ..... 169.88
3Com 33.6K w/XJACK ..... 169.99
3Com 33.6K cellular w/XJACK ..... 169.87
3Com 33.6K cellular ..... 169.87
3Com 33.6K 10BT LAN+modem ..... 259.16
3Com 33.6K 10BT LAN+modem combo ..... 299.83
3Com 56K w/XJACK ..... 214.66
3Com 56K cellular w/XJACK ..... 214.66
Hayes ACCURA 56Kflex ..... 184.16
Hayes OPTIMA 56K ..... 199.24
Hayes OPTIMA 56K w/EZjack ..... 199.24
Intel EtherExpress PRO/100 16-bit PC Card Enet/56K ..... 299.06
Practical Peripherals 56Kflex cellular ..... 166.41
Simple 33.6K Communicator w/SimpleJack .116.17
Simple 33.6K cellular ..... 118.03
Simple 56K Communicator ..... 149.02
Simple 56K Communicator Pro w/SimpleJack ..... 159.63
Xircom 56K ..... 167.54
Xircom 10/100+modem 56K ..... 319.29
Xircom 10/100+modem 56K w/MiniDock ..... 319.29

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56K x2 internal ..... 209.29
56K x2 external ..... 245.73
I-modem ISDN V.34 faxmodem external ..... 268.92

3Com U.S. Robotics

Winmodem V.34 33.6K internal w/fax ..... 57.87
V.34 33.6K internal w/fax ..... 84.32
V.34 33.6K external w/fax ..... 104.88
Voice V.34 33.6K internal w/fax ..... 109.44
Voice V.34 33.6K external w/fax ..... 137.30
56K V.90 internal ..... 157.99
56K V.90 external ..... 177.99
56K V.90 Voice internal ..... 177.99
56K V.90 Voice external ..... 247.99
56K Winmodem V.90 ..... 97.99
ISDN 128K terminal adapter ..... 176.25

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ACCURA ISDN ..... 229.04

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SurgeArrest Professional ..... 27.91
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BC Internet 325 2 outlets RJ11 ..... 79.89
BC PRO 450 4 outlets LAN port ..... 139.27
BC PRO 550 4 outlets LAN port ..... 169.80

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3Com PalmPilot Professional ..... 287.36
3Com PalmPilot III ..... 387.46
Hewlett-Packard 360LX Palmtop PC ..... 547.33
Hewlett-Packard 620LX Palmtop PC ..... 825.99
Philips Velo 1 ..... 449.00

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*New models are proliferating, prices are tumbling. Is it time to replace your CRT with a flat-panel display?*
*By Russell Kay*

# Thin's In: 20 LCD Monitors for Your Desktop

These days, a pretty good laptop with an active-matrix LCD sells for well under $2000. So why pay that much or more for a flat-panel desktop display that doesn't even include the computer?

It's not just trendiness. Tiny footprints, low power consumption, and plummeting prices are far more important reasons. Two years ago, LCD panels were gee-whiz devices costing $3000 or more. Times change. Today, some LCD monitors cost less than $1000. That may not be a bargain when a good-quality 17-inch CRT goes for $400, but it's a sign that LCD monitors are entering the mainstream.

Virtually every monitor vendor has or is planning a flat-panel model, and they're now optional with systems from the likes of Dell and Gateway. We took a reality check on 20 moderately priced LCDs, sized from 13.3 inches (diagonally) to 16.1 inches, priced from $899 to $3699.

All use basically the same active-matrix, thin-film transistor (TFT) LCD technology that we've become familiar with in laptops. But alternative flat-panel designs wait in the wings. For a look at these new technologies, see the text box "Alternative Flat-Panel Technologies" on page 92.

## What to Look For

Throw out conventional CRT and laptop display conventions when shopping for a flat-panel display. Instead, consider the following features:

**Brightness.** Brighter is almost always better. You can dim a too-bright display, but when you've got the brightness cranked all the way up and it's still not enough, you're stuck. Without the power, thickness, and weight constraints of laptop computers, desktop LCD panels can use brighter backlights. The desktop panels we examined were significantly brighter and had wider viewing angles than similarly sized laptop displays.

**Resolution.** Almost any supported resolution/refresh rate combination looks good on a CRT monitor. But an LCD panel is designed for one specific resolution, most often 1024 by 768 pixels.

**BYTE BEST**
**DESKTOP MONITORS**

**ViewSonic VPA150**
ViewSonic's fourth desktop LCD shows outstanding image quality, portrait mode, and a bargain price tag, making it both Best Overall and Best Value/Low Cost winner.

Switch one of these panels to, say, 800 by 600 pixels, and the image either shrinks dramatically (using only the central 800 by 600 pixels) or becomes ragged and uneven, because there's no longer a one-to-one correspondence between image pixels and physical-display pixels. This aliasing and pixellated interpolation of images is noticeable and objectionable in on-screen fonts. So plan to run your panel at its design resolution. If you need bigger on-screen images, either reconfigure the image with your application software or buy a bigger monitor.

**Pixel problems.** One small but annoying factor may be the presence of dead (black) or stuck—always on, even if the rest of the screen is black—pixels. Unfortunately, while LCD-panel makers try to build perfect displays, defects happen. Six of the tested panels had a stuck pixel. One vendor sent two identical units: One was perfect, and the other had two stuck pixels (one blue, one red). These problem pixels aren't normally visible, but they can sometimes be annoying. Check the display you buy carefully for dead or stuck spots and request another unit if you find any.

**Pivoting displays.** One neat feature to look for: a display that you can pivot 90 degrees from landscape to portrait. This is especially nice for Web pages or long documents, where extra length is helpful. Be aware, though, that rotating the panel interchanges horizontal and vertical viewing angles, and there may be video-card incompatibilities.

The PerfectPortrait software that came with the ViewSonic VPA150 wouldn't run on the Number Nine Revolution 3D card in our test platform, so we had to switch graphics cards. When we finally activated portrait mode, we found that if we moved a foot or so to the left of the monitor (the bottom in landscape mode), the image blacked out completely.

In fact, from squarely in front of the pivoted screen, the right side was considerably darker than the left side. If we rotated the entire display 5 or 10 degrees, or moved a little to the right, the screen was nice and even. But having to look at the monitor from the side seemed strange.

One final note: Make any adjustments before you pivot, because the on-screen display (OSD) doesn't rotate! We'd like to see the display automatically sense

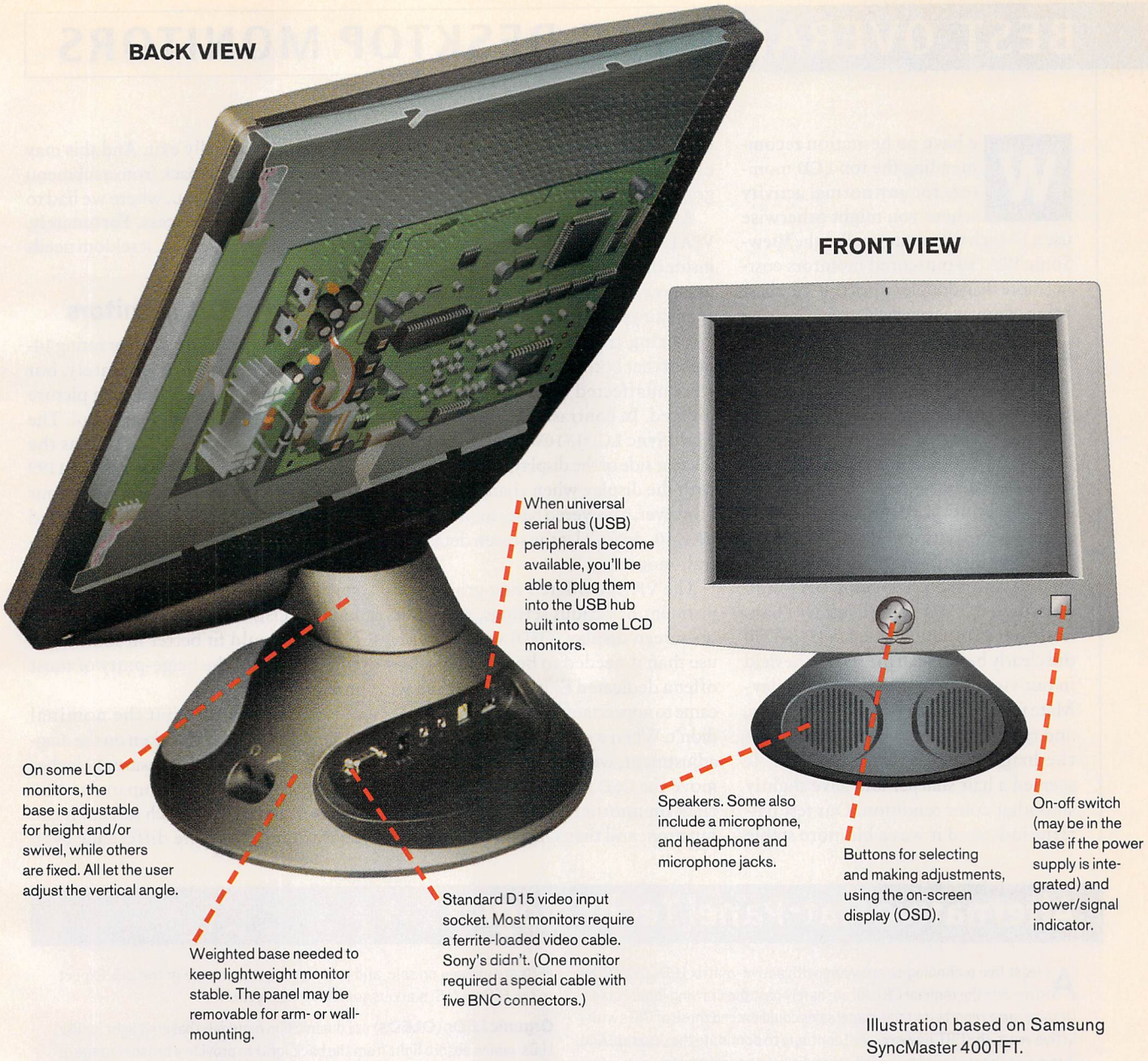



Illustration based on Samsung SyncMaster 400TFT.

rotation and adjust for landscape/portrait, as happens with pivoting CRTs.

**Antiglare.** All the panels except Compaq's had effective antiglare and/or antireflective coatings. Both Compaqs reflected considerable ambient light, which limits their applicability in many situations.

**Docking.** Think twice before committing to an LCD monitor if you plan to connect it to a docking station. Those units commonly disturb the video signal sufficiently to degrade image quality.

**Additional features.** One big advantage of a flat-panel display is that it takes up less space on a desktop. If it has built-in speakers, routes power and video cables nicely, and has a built-in universal serial bus (USB) hub for connecting peripherals, it will tidy up your physical desktop even more.

## Does Your Future Look Flat?

The financial industry has been a major early user of flat-panel displays. Brokers and traders often need to fit three monitors into a single workspace, and this crowd can afford whatever it wants.

However, unless their thinness and lightness solve a critical problem for you, it's most appropriate to consider flat panels like any true luxury: If you have to think about whether you can justify the cost, you can't. You can buy bigger CRT monitors, with more capabilities, for less money. In normal computing tasks, CRTs are more cost-efficient, if less space-efficient.

But if you can live with 1024 resolution and 15 viewable inches, and if you've got the money, we must confess it's a real pleasure to use these top-rated LCD monitors. Their images are crisp and bright, geometric distortion is essentially a nonissue, and we get back an enormous chunk of desktop real estate.

**Contributors**

Al Gallant, Technical Manager, BYTE Lab

Mike Naglie, IS Technician

Robert Pickering, BYTE Lab Technical Administrative Assistant

Dan Tanner, Technical Editor

ILLUSTRATION: SANDERS/TIKKANEN DESIGN & ILLUSTRATION © 1998

# BEST OVERALL LCD DESKTOP MONITORS

We have no hesitation recommending the top LCD monitors for any normal activity where you might otherwise use a 17-inch CRT monitor. But the ViewSonic VPA150 outscored monitors costing more than double its price; it's the best value of any we tested.

## Best Overall

The 15-inch VPA150 was the pick of the litter when we rated all tested units without regard for cost. It combined a full list of features (including speakers), 90-degree pivoting to portrait mode, an attractively low price (just reduced by 34 percent), and outstanding performance.

Judging these displays purely on image quality, only the $3699 Sony CPD-L150 outscored the VPA150 and just by a hair. Both the CPD-L150 and the $1445 VPA150 did clearly better than the rest of the field in our visual tests with Sonera DisplayMate test screens, photographic images, and type on-screen. The CPD-L150 was the brightest monitor we tested. It seemed a hair sharper and gave slightly smoother color rendition. Our test patterns indicated it was a bit more stable over extended viewing, but this was not evident in normal screen images and graphics.

Although it's only a small point, the VPA150's power circuitry was housed inside the base, so we had to connect only one power cord and didn't have to find room for yet another power-supply brick. Powering from the display base also meant that both power and video inputs were unaffected when the display was pivoted. In contrast, the pivoting NEC MultiSync LCD1510V had its inputs on the rear side of the display, so these moved with the display when changing modes. However, a powered base, such as on the VPA150, doesn't let the screen detach for wall-mounting.

The VPA150 offered fine-grained adjustment of various settings, though its on-screen display (OSD) was harder to use than it needed to be. Some displays offer a dedicated Exit button, which we came to appreciate. However, the VPA150 didn't. When we were finished making an adjustment, we had to use one button to move the OSD highlight to an Exit line, click on another button to select that function, and then click on the first button again to actually exit. And this may only have gotten us back from a submenu to the main OSD menu, where we had to repeat the whole process. Fortunately, once the display is set up, it seldom needs changing.

## Different-Size Monitors

Our original test plan called for rating 14- and 15-inch monitors separately, but the constantly changing pricing picture made those distinctions less useful. The Samsung SyncMaster 400TFT was the best of the 14-inch monitors, but its $1199 price isn't dramatically lower than our best-value 15-inch VPA150's estimated street price of $1445. It's a no-brainer to opt for the bigger one. If you prefer the smaller size, however, the Samsung unit has nice OSD controls, and its dark gray housing would fit better in some environments than the beige-putty of most monitors.

Remember, too, that the nominal screen measurement is taken on the *diagonal*. A 15-inch screen measures 12 inches wide by 9 inches high, compared to 11.2 by 8.4 inches for a 14-inch screen. It can be difficult to see the difference even

## Alternative Flat-Panel Technologies

At least five technologies are vying with active-matrix LCDs (AMLCDs) to replace the familiar CRT. All are barely past the drawing-board stage. Despite some reports that flat-panel sales could exceed those of CRTs within five years, the CRT, however, will continue to dominate the desktop. And it remains the standard by which other displays are measured.

**Electroluminescent displays (ELs)** are similar to LCD panels, doped with specific impurities to provide initial and final states in light-emitting transitions. ELs have fast video rates and good reliability and brightness. They can operate in a wide temperature range. However, they use high-voltage (>80 V) switching devices, their color isn't as pure as CRTs, they need lots of power, and they can wash out in bright light.

**Field emission display (FED)** technology is essentially a flat CRT. CRT monitors use an emitter to fire electrons onto a phosphor-coated faceplate or display screen. An FED uses thousands of emitters per pixel to do much the same thing. They're turned on/off by signals from row and column drivers that define the basic emitter cathode and gate. FEDs maintain high image quality by using voltages exceeding 5000 V. This also eliminates the bulk and power inefficiency of the CRT's scanning system and shadow mask. Compared to AMLCDs, FEDs have excellent contrast with rich colors, no viewing-angle problems, full-motion video (up to 5-microsecond response times versus 25 to 50 in AMLCDs), and an operating temperature range of -45°C to +85°C. They require about 30 percent less power for the same size and brightness display. In Japan, 5–6-inch FEDs are already on sale, and prototypes are available in the U.S. Expect to see FEDs in U.S. markets sometime next year.

**Organic LEDs (OLEDs)** use organic film materials that emit light (unlike LEDs, which absorb light from the backlight) to provide a broader range of brighter colors with more energy efficiency than LEDs. Cellular-phone-size screens have been prototyped, but a market-ready product is still at least a year away.

**Plasma display panel (PDP)** technology is based on the glow discharge that occurs when ionized gas recombines. Although it's well-established technology, PDP requires expensive high-voltage drivers; otherwise, the image tends to wash out in bright light. But if you don't mind a $12,000 price tag, it's the best 42-inch screen on the market.

**Vacuum fluorescent displays (VFDs)** can operate at lower voltages than PDP or EL displays. They use very thin layers of highly efficient phosphors coated directly onto each transparent anode in the display array. However, VFDs are relatively low-resolution, limited to a matrix of widely spaced phosphor dots for use in low-information-content applications. An expensive technology with niche applications, VFD lends itself to being tiled into billboard displays because it's viewable in sunlight.

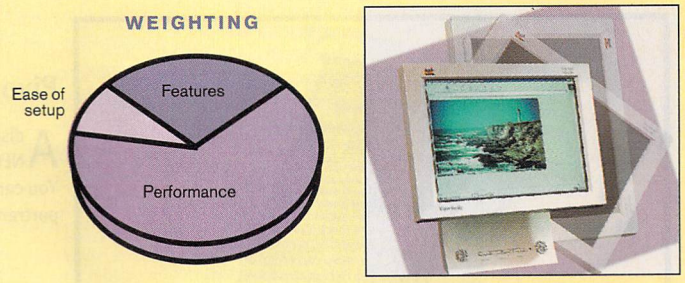
**Curt Ward**, *president of ABRe, a flat-panel display and semiconductor manufacturing engineering consulting firm and former member of the U.S. Display Consortium (*http://www.usdc.org*) technical council.*

# LAB RATING RESULTS

BEST OVERALL

**ViewSonic VPA150**

The ViewSonic VPA150 not only won the Best Overall honors, it placed first in our price/value rankings (see below). Besides providing outstanding performance, this 15-inch unit offers a substantial array of features, including portrait mode, integrated speakers, and an in-base power supply.

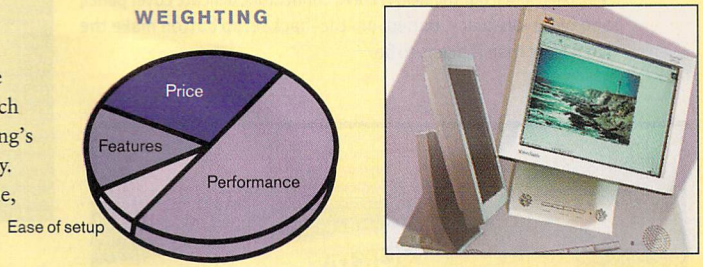



| | PRICE | DIAG. (IN.) | PERFORMANCE | FEATURES | EASE OF SETUP | OVERALL |
|---|---|---|---|---|---|---|
| **ViewSonic VPA150** | **$1445** | **15** | ★★★★★ | ★★★★★ | ★★★★★ | ★★★★★ |
| Sony CPD-L150 | $3699 | 15 | ★★★★★ | ★★★★ | ★★★★★ | ★★★★★ |
| Samsung SyncMaster 500TFT | $1499 | 15 | ★★★★ | ★★★★ | ★★★★★ | ★★★★ |
| Samsung SyncMaster 400TFT | $1199 | 14 | ★★★★ | ★★★ | ★★★★★ | ★★★★ |
| NEC MultiSync LCD1510V | $1499 | 14.1 | ★★★★★ | ★★★ | ★★★ | ★★★★ |
| LG Electronics 500LC | $1800 | 15.1 | ★★★★★ | ★★★ | ★★★ | ★★★★ |
| Mitsubishi LCD50 | $1499 | 15 | ★★★★ | ★★★ | ★★★★ | ★★★★ |

BEST VALUE

**ViewSonic VPA150**

ViewSonic's VPA150 (MSRP $1595, estimated street price $1445) virtually matched the performance of Sony's 15-inch CPD-L50 (MSRP $3699) at less than half the price. Samsung's 14-inch SyncMaster 400TFT placed second in this category. But check out prices for yourself. While proofing this article, we got one announcement after another about dropping (sometimes by $1000!) prices.




| | PRICE | DIAG. (IN.) | PERFORMANCE | FEATURES | EASE OF SETUP | VALUE |
|---|---|---|---|---|---|---|
| **ViewSonic VPA150** | **$1445** | **15** | ★★★★★ | ★★★★★ | ★★★★★ | ★★★★★ |
| Samsung SyncMaster 400TFT | $1199 | 14 | ★★★★ | ★★★ | ★★★★★ | ★★★★★ |
| Sceptre FT 15 | $999 | 14.5 | ★★ | ★★★★ | ★★★★ | ★★★★ |
| NEC MultiSync LCD1510V | $1499 | 14.1 | ★★★★★ | ★★★ | ★★★ | ★★★★ |
| IBM 9514-B23 | $1199 | 14.1 | ★★★★ | ★★★ | ★★ | ★★★★ |

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

when they're side by side, and bezel size and color can complete the illusion.

## Best Value

We found curiously little correlation between price and quality, or price and features, with these LCD monitors (see the chart on page 95). Again, the clear choice is the ViewSonic VPA150. Some monitors twice its price performed less well and offered fewer extras.

The second most expensive monitor in our tests, the 16-inch IBM 9516-B13 (a $2499 estimated street price as this is written), showed significantly less contrast and washed-out colors compared to the VPA150. It was also much more difficult to set up than the VPA150. We had to attach five of the old-style R, G, B, vertical, and horizontal BNC connectors instead of the usual VGA D15 plug.

## Runners-Up

The Sony CPD-L150's outstanding performance makes it a very good, albeit expensive, choice for demanding applications where color rendition is supercritical. It presented digital photographs more realistically and more consistently than any other monitor we tested. And the CPD-L150's ability to display 16.7 million colors gave it an advantage over the 262,000-hued VPA150.

If the budget is strapped but you need an LCD monitor, we suggest you try the 14-inch Samsung. It's smaller and doesn't perform quite as well, but the price may be right. We've seen it through some popular direct-mail channels for $1199.

We also liked the MultiSync LCD1510V. As the only analog display panel in the group, it can display more colors than any digital color monitor. Unfortunately, it also had the largest power supply. In fact, nothing about this monitor was small but the $1499 price tag. NEC offers an optional $300 ExtraView filter that we recommend for those who use portrait mode extensively. It affords a very wide viewing angle. But for most applications, with one primary user seated directly in front of the monitor, the less expensive unit is just fine. NEC plans to add touchscreen and protective-glass options later this year.

PHOTOGRAPHS: STEVEN GREENBERG © 1998

# DETAILS

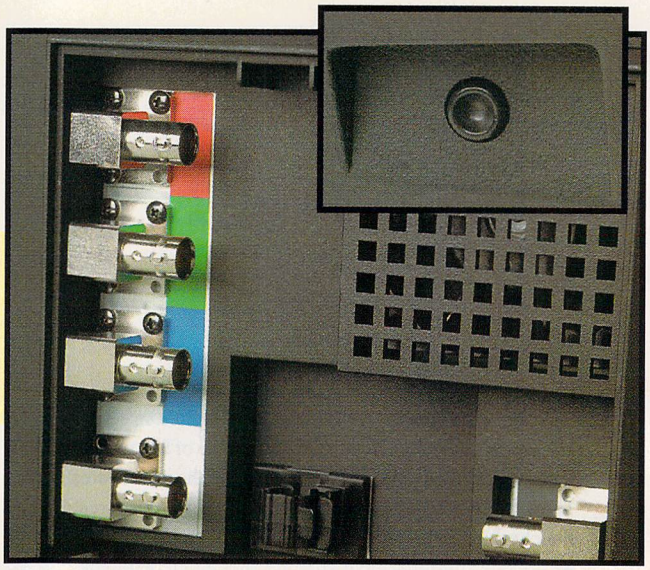


## Pivot to Portrait

A display that can pivot to an upright portrait mode, as shown on this NEC model, is a nice option for dealing with different computing tasks. You can use landscape mode for wide spreadsheets, for example, while portrait mode is just the ticket for Web surfing and word processing.

## Ease of Setup ...

It doesn't require a trained technician to install IBM's 16.1-inch display panel, but the RGBVH BNC connectors, delicate cover panel, and black-on-black, buried-on-the-back setup button make the job harder than it needs to be.






## ... and Ease of Adjustment

Most of these flat-panel monitors use only buttons to invoke adjustment menus and make selections. Nokia's push-and-turn knob is a refreshing alternative. In practice, it proved to be the easiest-to-use control system of any of the monitors we tested.

# TECH FOCUS

# LCD DISPLAY TUNING

## Forget Refresh; Watch the Clock Instead

CRTs refresh their screens one pixel at a time. Thus, screen refresh rate, the number of times per second screen data is repainted, is a critical consideration for flicker-free displays. LCDs refresh a row of pixels at a time, so rock-steady images are possible at nearly any reasonable refresh rate. On some units, you'll also be able to adjust separately the brightness of incoming video signals and of the LCD panel's backlight.

On an LCD monitor, the clock and phase adjustments are far more critical to high-quality displays. An LCD controller uses a sampling clock to determine the number of pixels per line needed to match data from the PC/graphics card combination. Mismatch those rates, and you'll likely see screen jitter, dark/light vertical banding of the image, or even complete loss of horizontal size.

Most LCD panels use the on-screen display (OSD) to make coarse and fine adjustment of the sampling clock, which determines the number of pixel samples obtained in one horizontal line pass. Phase adjustments bring the display into focus; this is sometimes called fine-tuning and is also made via the OSD. An out-of-phase condition can result in annoying screen jitter, loss of focus, or horizontal static in the image. A forthcoming Digital Flat Panel Initiative, aimed at piping a digital signal directly to the panel, should render clock and phase adjustments unnecessary.

Attaching an LCD panel to a portable requires unique settings, and it isn't always a happy pairing. We got the best notebook/panel pairings when we used the configuration settings for a CRT display, not an LCD panel. You'll still need to tweak the phase and clock adjustments for best image quality and viewability, and many notebook video controllers' limited memory may not support more than 256 colors.

**-Dan Tanner and Mike Naglie**

These LCD panels simply don't work like CRTs. We can measure many factors that affect a CRT's image quality (e.g., focus, convergence, dot blooming), but most don't apply to LCD panels.

The numbers needed by display-panel engineers don't really tell us much about whether one monitor is better than another. We measured brightness, color temperature, color balance, and RGB output with a Minolta CA-110 color analyzer (*http://www.minoltausa.com/*), but the numbers had little correlation with our visual assessments.

The Sony CPD-L150 panel was the brightest monitor, at 203 nits (a nit is 1 candela per square meter), but its darkest screen was then much too bright (i.e., "black" wasn't black). Just behind the CPD-L150 in brightness was the Mitsubishi LCD50, with better blacks, but it finished at the bottom of our top-rated group. The LG 500LC panel was dimmest overall, at 151 nits, but it looked better than the LCD50. Go figure.

Ultimately, we relied on a far more sensitive and discriminating optical sensor: the human eye. Take a cue from this and use your own eyes to make a final LCD-panel selection. They're the most valuable tool you have in choosing the display that's best for your work environment.

## Turning On, Tuning In

In pairs, we connected the panels to identical test systems: 200-MHz Pentium Pro Compaq Proliant 800s running Windows 95. We used PCI-based 8-MB Revolution 3D graphics cards from Number Nine, chosen for outstanding signal integrity. A few years ago, LCD monitors needed special graphics cards, but these units work with any standard card.

We did a detailed setup using selected screens from Sonera Technologies' DisplayMate Multimedia for Windows (see *http://www.sonera.com/*). Then we ran through additional DisplayMate screens, each focusing on a specific aspect of display quality. With some monitors (e.g., the CPD-L150 and the Samsung SyncMasters), it was easy to correct phasing. On other units (e.g., the Nokia 500Xa and LG 500LC), we couldn't eliminate all visible interference. Most panels were sharp; only a few, notably Compaq's TFT500, were fuzzy on text.

We looked at each panel's ability to differentiate among the darkest near-black areas and the lightest near-white areas in a 256-level gray scale. Measured range didn't equate with visual impact. Some panels could distinguish the deep blacks and bright whites, but still looked flat.

Finally, we looked at color. Most panels did a good job, though the IBM 9516-B13 and Sceptre FT 15 were noticeably deficient and distorted colors. The better monitors showed an even falloff as signals faded to black.

While most monitors warmed up quickly, the NEC MultiSync LCD1510V needed nearly an hour to go from 130 nits to its ultimate 171. Thus, you probably wouldn't want to turn that monitor off, though it's unclear how this might affect the backlight's life.

## Making the Cut

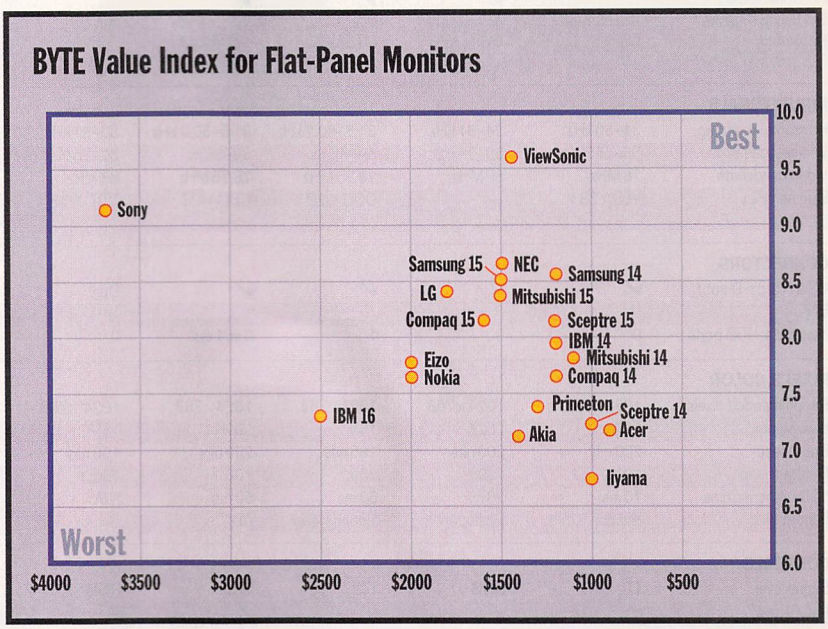
As we set up the panels with two displays running side by side, it was quite apparent that some monitors were very good indeed, and some were not. Our first test pass showed that 10 panels were better than the rest.

With the finalists, we examined a variety of images. Viewing two panels side by side quickly revealed subtle differences in color reproduction and scaling. We readjusted as necessary, to give each panel its best chance and eliminate any overall biases in color balance.

On each successive comparison, we eliminated one panel. The Sony CPD-L150 was our "eyeball" winner, with the ViewSonic VPA150 almost as good. We combined these rankings with scores based on individual DisplayMate tests to arrive at the performance scores in the ratings table. Here, the VPA150 moved slightly ahead of the CPD-L150.

To calculate performance ratings, we weighted sharpness at 10 percent, overall image quality at 40 percent, evenness of illumination at 15 percent, color rendition at 15 percent, and our eyeball ratings at 20 percent.

In overall scores, we weighted performance at 70 percent, features at 25 percent, and ease of setup at 5 percent. For the value ratings, price was at 30 percent, performance at 50 percent, features at 15 percent, and setup at 5 percent.




*Russell Kay (**russell.kay@byte.com**) is a BYTE technical editor.*

*Evaluations in this report represent the judgment of BYTE editors, based on tests conducted in the BYTE Lab.*

# FLAT-PANEL LCD MONITORS FEATURES

| | Acer Peripherals AcerView F31 | Akia Radiance VX145 | Compaq Computer TFT450 | Compaq Computer TFT500 | Eizo Nanao Technologies FlexScan L34 | IBM 9516-B13 | IBM 9514-B23 | iiyama NA Prolite 36/ TXA3601GT | LG Electronics 500LC |
|---|---|---|---|---|---|---|---|---|---|
| Price (MSRP or ESP) | $899 ESP | $1399 MSRP | $1199 ESP | $1599 ESP | $1999 ESP | $2499 ESP | $1199 ESP | $998 MSRP | $1800 MSRP |
| Overall rating | ★★★ | ★★★ | ★★★ | ★★★★ | ★★★ | ★★★ | ★★★ | ★★ | ★★★★ |
| **DISPLAY CHARACTERISTICS** | | | | | | | | | |
| Inches, diagonal | 13.3 | 14.5 | 14.5 | 15 | 15 | 16.1 | 14.1 | 14.1 | 15.1 |
| Screen surface coating* | G, S | G | G, S | R, S | G | G, R, S | G, R, S | G, R, S | R |
| Left/right viewing angle | 70/70 | 60/60 | 60/60 | 60/60 | 70/70 | 45/45 | 45/45 | 50/50 | 60/60 |
| Up/down viewing angle | 70/70 | 20 | 105 | 90 | 60/60 | 20/45 | 15/45 | 15/30 | 90 |
| Portrait mode (software support) | | | | | | | | | |
| Wall-hangable? | | ✔ | ✔ | ✔ | | ✔ | ✔ | | |
| Arm-mountable? | | ✔ | ✔ | ✔ | | ✔ | ✔ | | |
| Operating systems supported | Any current OS | Any current OS | Win 3.1/95/ NT, Mac OS | Win 3.1/95/ NT, Mac OS | Any | DOS, Win 95/NT, OS/2 | DOS, Win 95/NT, OS/2 | Any | DOS, Windows, Mac OS |
| **INPUT SIGNALS** | | | | | | | | | |
| Horizontal scanning | 31–60 kHz | 24–61 kHz | 31.5–60.2 kHz | 31.5–60.2 kHz | 30–61 kHz | 30–80 kHz | 24–62 kHz | 23–62.5 kHz | 31–61kHz |
| Vertical scanning | 56–75 Hz | 50–90 Hz | 59–85 Hz | 59–85 Hz | 50–85 Hz | 55–120 Hz | 55–88 Hz | 50–200 Hz | 56–75 Hz |
| Video bandwidth | 78 MHz | 80 MHz | 78.75 MHz | 78.75 MHz | 80 MHz | 68–135 MHz | 40–80 MHz | 79 MHZ | 80 MHz |
| Plug and Play | VESA 2B | | DDC 1/2B | DDC 1/2B | DDC 1/2B | VESA DDC 1/2B | DDC 2B | DDC 1/2B | DDC 2B |
| **CONNECTORS** | | | | | | | | | |
| VGA (15-pin D-sub) | ✔ | ✔ | ✔ | ✔ | Dual | ✔ | ✔ | ✔ | ✔ |
| BNC | | | | | | ✔ | ✔ | | |
| Number of USB ports | 0 | 0 | 1 | 3 in/1 out | 0 | 0 | 0 | 0 | 0 |
| **PIXELS, COLOR** | | | | | | | | | |
| Recommended pixels | 1024×768 | 1024×768 | 1024×768 | 1024×768 | 1024 ×768 | 1280×1024 | 1024×768 | 1024×768 | 1024×768 |
| Max. colors | 16M | 262K | 16M | 262K | 16M | 16M | 16M | 16M | 16M |
| Brightness | 200 nits | 200 nits | 185 nits | 200 nits | 150 nits | 200 nits | 200 nits | 150 nits | 200 nits |
| Contrast ratio | 100:1 | 100:1 | 200:1 | 100:1 | 150:1 | 100:1 | 200:1 | 150:1 | 150:1 |
| LCD response time | 70 ms | 28 ms | 50 ms | 50 ms | N/A | 30 ms | 30 ms | 40 ms | 20 ms |
| Panel maker | Hitachi | Hoshiden | Not provided | ADI | Sharp | DTI | DTI | NEC | LG |
| **CONTROLS** | | | | | | | | | |
| Signal level | TTL | RGB | TTL | TTL | RGB | TTL | TTL | TTL | RGB |
| Auto-sizing? | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| **MULTIMEDIA** | | | | | | | | | |
| Inputs | | | Optional | Optional | | | | | |
| Outputs | | | | | | | | | |
| Integrated speakers (number, wattage) | | 2 @ 1 W | | | | | | | |
| Integrated microphone | | | | | | | | | |
| **PHYSICAL, ELECTRICAL CHARACTERISTICS** | | | | | | | | | |
| Power input (VAC/Hz) | 90–264 V, 50/60 Hz | 100–240 V, 50/60 Hz | 90–132/ 195–265 V, 47–63 Hz | 90–132/ 195–265 V, 47–63 Hz | 100–120 V, 50/60 Hz | 100–240 V, 50/60 Hz | 100–240 V, 50/60 Hz | 90–132 V, 50/60 HZ | 110 V, 60 Hz |
| Power (active sleep) | 36 W/5 W | 35 W/5 W | 35 W/8 W | 55 W/5 W | 32 W/5 W | 55 W/8 W | 30 W/8W | 27 W/6 W | 40 W/5 W |
| H×W×D, w/ base (inches) | 133.1×144.1×66.9 | 12.5×15.5×6.5 | 15.6×14.4×8.6 | 17.2×15.1×9.1 | 15.6×15.6×6.9 | 16.1×17.0×9.8 | 13.8×14.9×7.4 | 14.2×15.4×7.8 | 14.5×15.7×7.2 |
| FCC rating (class) | FCC-B | FCC-B | FCC-B | FCC-B | FCC-A | FCC-A | FCC-B | FCC-B | FCC-B |
| Compliance | TCO95, MPR 2 | VESA, DPMS | TCO92, MPR 2 | TCO95, MPR 2 | TCO95, MPR 2 | TCO92 | MPR 2/ MPR 3 | TCO95 | TCO95 |
| **CUSTOMER SUPPORT/VENDOR INFORMATION**** | | | | | | | | | |
| Warranty length (years)/ coverage | 1 year (R) | (3 yeasr limited)/yr 1=pixel defects (2 adjacent or 8 total); 2&3= mechanical | 3 years P, 1 year backlight, 1 year on-site L, F & R | 3 years P, 1 year backlight, 1 year on-site L, F & R | 3 years CRT (or LCD backlight), P & L | 3 years /F & R | 3 years /F & R | 3 years/ 1 year backlight | 3 years F & R within first year, R for 2–3 years |
| Web address | http://www .acerperipherals .com | http://www.akia .com | http://www .compaq.com | http://www .compaq.com | http://www .eizo.com | http://www.ibm .com.pc/us/ options | http://www.ibm .com.pc/us/ options | http://www .iiyama.com | http://www .lgeus.com |
| **HotBYTEs Number** | **1062** | **1063** | **1064** | **1065** | **1066** | | | **1069** | **1070** |

= BYTE Best ✔=yes; N/A=not applicable.

**Warranty:** P=parts; L=labor; F=freight to repair center; R=return to customer.

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor



Enter HotBYTEs No. at http://www.byte.com/hotbytes/

| Mitsubishi LCD40 | Mitsubishi LCD50 | NEC Technologies MultiSync LCD1510V | Nokia Display Products 500Xa | Princeton Graphic Systems LD50A | Samsung SyncMaster 400TFT | Samsung SyncMaster 500TFT | Sceptre BT 15+ | Sceptre FT 15 | Sony Electronics CPD-L150 | ViewSonic VPA150 |
|---|---|---|---|---|---|---|---|---|---|---|
| $1099 ESP ★★★ | $1499 ESP ★★★★ | $1499 ESP ★★★★ | $1999 MSRP ★★★ | $1299 ESP ★★★ | $1199 ESP ★★★★ | $1499 ESP ★★★★ | $1199 ESP ★★★★ | $999 ESP ★★★ | $3699 ESP ★★★★★ | $1445 ESP ★★★★★ |
| 14 | 15 | 14.1 | 15.1 | 13.8 | 14 | 15 | 15.1 | 14.5 | 15 | 15 |
| G, R | G, R | G, R, S | G | G, R, S | N/A | N/A | G, H, R | G, H, R | N/A yet | G, H |
| 70/70 | 70/70 | 50/50 | 50/50 | 70/70 | 60/60 | 60/60 | 50/50 | 50/50 | 70/70 | 60/60 |
| 60/50 | 70/50 | 30/40 | 60/60 | 55/55 | 40/40 | 40/40 | 40/55 | 20/60 | 60/60 | 45/45 |
| | | ✔, PC/Mac | | ✔ | | | | | ✔, PC/Mac | ✔, with free PerfectPortrait software |
| ✔ | ✔ | ✔ | ✔ | ✔ | | | ✔ | ✔ | ✔ | |
| ✔ | ✔ | ✔ | ✔ | | | | ✔ | ✔ | ✔ | |
| Any | Any | Any | Windows, Mac OS, Unix | PC, Mac OS | All major OSes | All major OSes | Win 95 | Win 95 | Win 3.x/95/98, Mac OS/OS8 | Win 95/NT, Mac OS, OS/2 |
| 30–61 kHz | 30–61 kHz | 24.8–60 kHz | 29–62 kHz | 31.5–60.2 kHz | 30–50 kHz | 30–50 kHz | 24–61 kHz | 24–1 kHz | 50–85 kHz | 48 kHz |
| 56.3–85.1 Hz | 56.3–85.1 Hz | 56.2–85.1 Hz | 55–75 Hz | 75 Hz | 60–70 Hz | 60–70 Hz | 56–85 Hz | 56–85 Hz | 30–70 Hz | 60 Hz |
| 80 MHz | 80 MHz | 80 MHz | 80 MHz | 80 MHz | 65 MHz | 65 MHz | Not provided | Not provided | Not provided | 82 MHz |
| VESA DDC1/2B | VESA DDC1/2B | VESA DDC2B | VESA 2B | N/A | VESA 2B | VESA 2B | DDC1/2B | DDC1/2B | DDC1/2B | DDC1/2B |
| ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| 0 | 0 | 0 | 0 | 0 | 2 | 2 | Optional | 0 | 0 | 0 |
| 1024×768 | 1024×768 | 1024×768 | 1024×768 | 1024×768 | 1024×768 | 1024×768 | 1024×768 | 1024×768 | 1024×768 | 1024×768 |
| 262K | 262K | Unlimited | 16M | 262K | 262K | 262K | 262K | 262K | 16M | 262K |
| 180 nits | 200 nits | 200 nits | 250 nits | 200 nits | 200 nits | 200 nits | 250 nits | 200 nits | 200 nits | 200 nits |
| 140:1 | 150:1 | 150:1 | 150:1 | 300:1 | 150:1 | 150:1 | 150:1 | 100:1 | 300:1 | 200:1 |
| 50 ms | 50 ms | 35 ms | 50 ms | 30 ms | 30 ms | 30 ms | 28 ms | 28 ms | N/A | 30 ms |
| Panasonic | Sharp | NEC | Phillips | Sharp | Samsung | Samsung | Not provided | Not provided | Not provided | Not provided |
| RGB | RGB | TTL | TTL | RGB | RGB | RGB | RGB | RGB | TTL | RGB |
| ✔ | ✔ | ✔ | ✔ | ✔ | | | | | ✔ | ✔ |
| VGA | VGA | | Audio | | Audio mic | Audio mic | Headphone jack | Sound card | 1 | Analog HD-15 mini |
| | | | Headphone/ microphone | | USB | USB | 2 speakers w/Amp | Headphone | 1 | |
| | | | 2 @ 3W | | 2 @ 3W | 2 @ 3W | 2 @ 1 watt/ chan w/Amp | 2 @ 1 watt/ chan w/Amp | | 2 @ 1 watt/chan |
| | | | ✔ | | ✔ | ✔ | | | | |
| 100–120/ 220–240 V, 50/60 Hz | 100–120/ 220–240 V, 50/60 Hz | 100–120/ 220–240 V, 50/60 Hz | 90–260 V, 50/60 Hz | 100–240 V, 50/60 Hz | 90–264 V, 50/60 Hz | 90–264 V, 50/60 HZ | 90–260 V, 50/60 Hz | 90–260 V, 50/60 Hz | 100–240 V, 50/60 Hz | 90–264 V, 50/60 Hz |
| 40 W | 45 W | 50 W/5 W | 32 W/5 W | 21 W/3 W | 45 W/5 W | 45 W/5 W | 38 W/4 W | 38 W/4 W | 35 W/4 W | 40 W/15 W |
| 11.1×14.7×6.3 | 11.1×14.7×6.3 | 12×9×8 | 13.58×15.39×3.35 | 13x14×6.5 | 14.3×15.7×8.7 | 15.1×16.7×8.7 | 13×15.5×7 | 13×15.5×7 | 14.4×15.7×11.7 | 15.2×15.6×6.7 |
| FCC-B | FCC-B | FCC-B | FCC-B | FCC-B | | | FCC-B | FCC-B | FCC-B | FCC-B |
| MPR 2, TCO95 | MPR 2, TCO95 | TCO92, CE | TCO 95 | TCO92 | TCO95; MPR 2 | TCO95; MPR 2 | TCO95 | TCO95 | TCO95 | TCO95 |
| 3 years P & L; one-way F | 3 years P & L; one-way F | 3 years P & L, 1 year backlight/R | 3 years, exclude backlight F (up to 30 days), R | 1 year | 3 years P & L; 1 year backlight | 3 years P & L; 1 year backlight | 3-year limited warranty (P) and 1-year LCD & L | 3-year limited warranty (P) and 1-year LCD & L | 3 years on P & L, 1 year on backlight, F & R to corporate purchasers | 3 years on P & L, and 1 year on LCD backlight |
| http://www .mitsubishi-display.com | http://www .mitsubishi-display.com | http://www .NEC.com | http://www .nokia.com/ americas | http://www .prgr.com | http://www .sosimple .com | http://www .sosimple .com | http:// sceptre .com | http:// sceptre .com | http://www .sony.com/ displays | http://www .viewsonic .com |
| **1071** | **1072** | **1073** | **1074** | **1075** | **1076** | **1077** | **1078** | **1079** | **1080** | **1081** |

* (G=antiglare, H=hardcoating, S=antistatic, R=antireflective) ** Access vendor Web site for latest price, warranty, service, support, and terms and conditions.

*We test data-distribution solutions for forgetful administrators and information-hungry clients.*
*By Barry Nance*

# When Push Comes to Serve

Encounter a missing-file condition after working for hours with a client/server application, and you really know intense frustration. But it's more insidious to run an application with incorrect file versions and not realize your results are fatally flawed. When using a file or Web server, you assume the right files are in the right directories. But how do you know?

Some applications try to avoid the problem by having each user run a client-side installation-verification program before entering data. Such programs warn the user when they find out-of-date or missing files. A few applications do this when they're started. Unfortunately, such verification typically consumes considerable bandwidth and drains several minutes a day from users' productivity.

A better approach to missing-file and wrong-file problems is to use push server software. Typically, a *push server* consists of a small agent component running on each client, plus a central server for controlling and managing the distribution of data. The administrator, not the client, tells the server what to distribute, where to put it, and when to send. These products can be costly, but most of them handle the easily overlooked and potentially costly details concerning which files belong in what directories. Others let administrators distribute dynamic Web content, application alerts (e.g., "XYZ Widget Low-Inventory Warning"), Java components, and other material.

For this report, we evaluated eight push server products (not services, such as PointCast): BackWeb InfoCenter 4.0; Marimba's Castanet 2.1; Netpresenter's Netpresenter 3.0; StarBurst Communications' StarBurst Multicast 3.03; Tibco's Rendezvous 4.2; Wall Data's Cyberprise Server 2.0; Wayfarer's Wayfarer 4.0; and XcelleNet's RemoteWare Express 1.2. We looked closely at performance, network impact, ease of administration, security, and price.

We tested on a 100-Mbps Fast Ethernet network with 25 Windows 95, OS/2 Warp, and Macintosh System 7 clients connected to two Gateway 2000 NT Server machines—an NS8000 with dual 333-MHz CPUs, 512 MB of RAM, and 27 GB of disk space; and an NS7000 333-MHz single-CPU server. To test support for disparate network speeds, we connected 10 clients to the LAN with T1 lines (using Cisco routers and Larscom CSU/DSU devices), 56-Kbps modems, and ISDN lines.

**BYTE BEST**
**PUSH SERVERS**

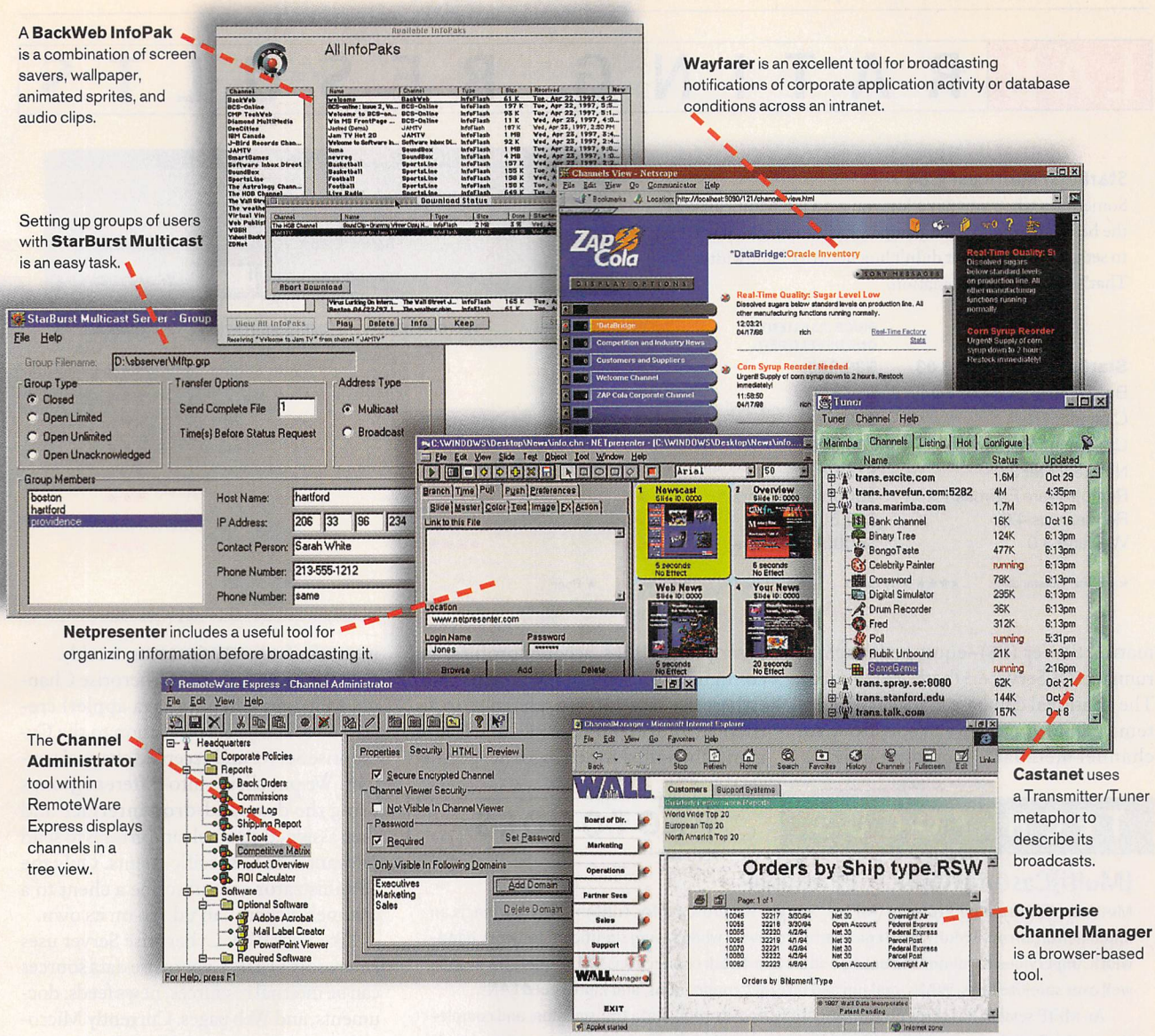
**StarBurst Multicast 3.03**
This package pushed out data faster—and with less impact on network resources—than any other. It's expensive, but it does the job impressively well.

## BackWeb InfoCenter 4.0

InfoCenter impressed us with its ability to distribute both files and Web content. Administering InfoCenter was as simple as creating a new BackWeb channel, configuring it to distribute data on a preset schedule, identifying the data to be propagated, and selecting a group of target clients. BackWeb supports standard, file-delivery, and Web channels, as well as channels based on Microsoft's Channel Definition Format (CDF). All of them were quick and easy to set up. When we set up a Web channel, for example, InfoCenter launched its Profile Wizard to ask us what Web page, and what part of that page, we wanted to monitor for changes and new information. Profile Wizard correctly handled tables and frames in the monitored Web pages.

Standard channels connect clients to BackWeb Polite Servers, which let administrators distribute InfoPaks—combinations of screen savers, wallpaper, animated sprites, and audio clips. Instead of HTTP, a Polite Server uses its own unobtrusive, low-bandwidth protocol for transmitting data. File-delivery channels are well suited to the distribution of data files and documents, such as administrative manuals. In the BYTE Lab, InfoCenter used CDF to let us view BackWeb channels from within Internet Explorer 4.0. Acting as developers, we used InfoCenter's Java interface and the BackWeb Application Language Interface (BALI) to create and customize our InfoPaks.

InfoCenter also let us monitor news items and display them in ticker form on the screen. We especially liked the client filter and alert features, which let us cull out irrelevant Web and news content. Similarly, InfoCenter could notify us immediately if it discovered Web pages or news items containing our selected key words and phrases. After we selected 20 of the 500 presupplied channels and specified our selection criteria, InfoCenter dutifully broadcast the news items to our clients. Overall, InfoCenter was best suit-




**Distributing Web content, files, and data to networked clients is the fundamental mission of push servers.**

ed for distributing several kinds of data in a mostly Microsoft environment.

## Castanet 2.1

Castanet is a superior tool for distributing Java applications and components. Slower than StarBurst Multicast in our tests, it uses incremental byte-level differential downloads instead of IP Multicast to cut network traffic. Castanet used Secure Sockets Layer (SSL) and digital certificates to securely broadcast class files and other material to our clients.

In Castanet, a *channel* is an application, service, or collection of data to be distributed over a network. A Castanet Transmitter (the server) manages and controls data distribution, while a Castanet Tuner (the client software) receives items. A channel can be all or part of a Web site, be a presentation pipeline for graphical applications, carry Java code, or distribute data.

Using Castanet was nearly effortless. We set up several channels, configured their update schedules, and supplied each with content. Each Tuner contacted the channel's Transmitter, asked if updates existed, and downloaded the new material. Temporarily off-line Tuners postponed their checks until we restored the network connection. Allocate a channel to the task, and Tuners can update themselves.

For those who want to create customized Castanet channels with a unique appearance, Marimba offers Bongo, a visual interface builder for Java that includes a wide library of visual controls. Creating new presentation channels was easy and fun; we dragged and dropped Bongo controls and wrote a bit of event-driven Java code to bind them together. Those with Java-based vertical applications will find Castanet a good tool for ensuring that an applet or data file is in the right location.

## Cyberprise Server 2.0

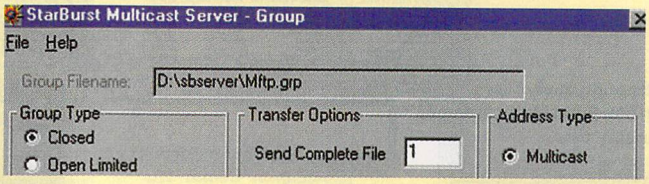
Like Castanet and BackWeb, Cyberprise Server uses a channel metaphor to help distribute mainframe-originated, intranet, and Internet content to browser-based clients. We installed it on an Internet Infor-

# LAB RATING RESULTS

BEST OVERALL

**StarBurst Multicast 3.03**

Sometimes when you pay a lot, you get a lot. Multicast was the best performer of the group by a wide margin; it was easy to set up and use, and it didn't hog network bandwidth. That's a winning combination.




| | PRICE (25 CLIENTS, ONE DEVELOPER) | PERFORMANCE | TECHNOLOGY | IMPLEMENTATION | OVERALL |
|---|---|---|---|---|---|
| **StarBurst Multicast 3.03** | **$39,900** | ★★★★ | ★★★★ | ★★★★ | ★★★★ |
| BackWeb InfoCenter 4.0 | $10,500 | ★★ | ★★★★ | ★★★★ | ★★★ |
| Castanet 2.1 | $995 | ★★ | ★★★ | ★★★★ | ★★★ |
| Cyberprise Server 2.0 | $25,000 | ★★ | ★★★ | ★★★ | ★★★ |
| Netpresenter 3.0 | $1560 | ★★ | ★★ | ★★★ | ★★ |
| RemoteWare Express 1.2 | $5000 (100 users) | ★★ | ★★★ | ★★★★ | ★★★ |
| Rendezvous 4.2 | $12,500 | ★★★ | ★★★★ | ★★★★ | ★★★★ |
| Wayfarer 4.0 | $5000 (100 users) | ★★ | ★★★★ | ★★★ | ★★★ |

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

mation Server (IIS)–equipped machine running SQL Server 6.5 (both are required). The relational database management system (RDBMS) acted as a repository for channel metadata, including indexes, descriptions, URLs, account profiles, and configured presentation characteristics. Cyberprise Server stored references to distributed information as URLs, and it automatically polled for changes at specified intervals, from 10 minutes to weekly.

In the BYTE Lab, the Cyberprise Channel Manager Client (a Java applet) created a socket-level connection to the Cyberprise Server and accepted channel content. We put clients into different groups using the drag-and-drop interface and then assigned channels and groups to send relevant data to specific clients. Only the administrator can subscribe a client to a channel; a client can't do so on its own.

Like BackWeb, Cyberprise Server uses Microsoft's CDF. Cyberprise data sources can be internal resources, news feeds, documents, and Web pages. Currently Microsoft-centric, it's a useful tool for organizing data on dynamic corporate intranets.

## StarBurst Multicast 3.03

Using StarBurst's MFTP protocol, an enhanced IP Multicast transport, we quickly and effortlessly distributed program and data files to specified locations on our network. Setting up scripts to automate data distribution was easy, and we could use Multicast's graphical interface to specify such parameters as scheduling and amount of bandwidth.

The fastest product we tested, Multicast also used the least network resources. MFTP sent a single stream of data to a group of clients and then expected each client to report a successful or incomplete transfer (see the Tech Focus at left). LAN-connected clients received data as fast as they could take it. For clients that couldn't keep up, Multicast restarted transfers at a slower

## TECH FOCUS: PROTOCOLS

### (Multi)Casting About for Protocols

**Multicast File Transfer Protocol (MFTP), StarBurst's protocol for content distribution, is an implementation of IP Multicast. It guarantees delivery while saving significant network bandwidth. Impervious to round-trip delays and slow network connections, MFTP operates equally well over satellite links, WANs, dial-up and Internet connections, and high-speed LANs.**

**An MFTP session has three phases: announce/registration, data transmission, and completion. In the first phase, a server multicasts a message telling clients that a data transfer is imminent. Intended recipients register with the server to receive the transfer. In the second phase, the server divides the data to be transmitted into blocks of frames and sends these in one transmission to all registered receivers (which is the essence of IP Multicast).**

**Each receiver notes any lost or damaged frames and requests retransmission of those frames via an efficient negative-acknowledgment scheme instead of pausing for acknowledgments. In subsequent passes, the MFTP server sends just the lost or damaged frames. The protocol depends on clients' notifying the server of missing frames or, at the completion of transmission, a successful transfer. As a side effect of this approach, the server can restart interrupted transfers without resending already-transmitted material.**

**However, not everything is rosy. IP Multicast messages are connectionless User Datagram Protocol (UDP) TCP/IP frames containing special destination addresses. IP Multicast uses UDP frames to avoid crushing the network (not to mention the sender) with "Yes, I received it" acknowledgments from every multicast receiver. Unfortunately, the most common type of firewall—the application gateway—cannot secure connectionless protocols, and many organizations configure their firewalls to drop such messages. One way to overcome this is to establish a generic service pass for all packets coming through certain ports at the firewall; unfortunately, this also defeats some of the firewall's security. StarBurst Multicast and Tibco's Rendezvous can fall back to message broadcasting when faced with impenetrable firewalls, but you then lose the significant bandwidth savings of IP Multicast. Tibco also offers a proxy agent that can pass selected multicast traffic on a firewall computer.**

| PUSH SERVERS FEATURES | BackWeb InfoCenter 4.0 | Marimba Castanet 2.1 | Netpresenter B.V. Netpresenter 3.0 | StarBurst Multicast 3.03 (B) | Tibco Rendezvous 4.2 | Wall Data Cyberprise Server 2.0 | Wayfarer Wayfarer 4.0 | XcelleNet RemoteWare Express 1.2 |
|---|---|---|---|---|---|---|---|---|
| **DATA DISTRIBUTION** | | | | | | | | |
| IP Multicast | | | | ✔ | ✔ | | | |
| Compression | ✔ | | | | | | | ✔ |
| Incremental updates | ✔ | ✔ | | | | ✔ | ✔ | ✔ |
| **INTERFACE** | | | | | | | | |
| Graphical interface | ✔ | ✔ | ✔ | ✔ | Separate product | ✔ | ✔ | ✔ |
| Scripts | ✔ | | ✔ | ✔ | | | ✔ | ✔ |
| **PROGRAMMABILITY** | | | | | | | | |
| Java | | ✔ | | ✔ | ✔ | ✔ | ✔ | |
| C/C++ | ✔ | | | ✔ | ✔ | ✔ | ✔ | |
| Visual Basic | ✔ | | | | ✔ | | ✔ | |
| **PLATFORMS** | | | | | | | | |
| Windows NT | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ |
| OS/2 | | | | ✔ | ✔ | | | |
| Windows 95 | | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ |
| Windows 3.1 | | ✔ | ✔ | ✔ | ✔ | | ✔ | ✔ |
| **UNIX** | | | | | | | | |
| Sparc | ✔ | ✔ | | ✔ | ✔ | | | |
| RS/6000 | | | | ✔ | ✔ | | | |
| SGI | | | | ✔ | ✔ | | | |
| DEC Alpha | | | | ✔ | ✔ | | | |
| Hewlett-Packard | | | | ✔ | ✔ | | | |
| Intel (SCO) | | | | ✔ | ✔ | | | |
| **SECURITY** | | | | | | | | |
| Digital certificates | | ✔ | | | | ✔ | | |
| RSA or other encryption | | | | | | ✔ | ✔ | |
| SSL | | ✔ | | | | ✔ | | |
| Microsoft Crypto | | | | | | | | ✔ |

(B) = BYTE Best ✔ = yes

rate. Multicast handled interruptions nicely, resuming the transfer process without resending already-transferred data.

To transfer files, we established named client groups, specifying filenames and locations, and configuring transfer parameters (e.g., transmit rate). StarBurst supplies several templates to support varying networks and application requirements.

Adjustability of transmission rate was a nice feature. We could allocate a specified amount of bandwidth to the transfer. With our developer's hat on, we used the SDK's API in a C++ program to define and control user groups, configure and initiate transfers, and monitor transfer status.

StarBurst Multicast is expensive, but a large organization that's highly dependent on having the right information in the right place, and on time, should find that the benefits outweigh the cost.

## Netpresenter 3.0

One of the first push servers to appear on the market, Netpresenter offers easy-to-use tools for creating, customizing, and broadcasting news channels to clients. We used the product in its most common mode, where materials are delivered to clients via a screen-saver news ticker.

With the Netpresenter editor, we were able to integrate a variety of multimedia—including animations and audio clips, as well as Web pages and hyperlinks—into our news channels. We used Internet Explorer to enter messages, which the Intratext Server component distributed to clients. We did not test the use of material from teletext services, such as CNN.

Netpresenter also offers rudimentary group-scheduling functions and can nest news-channel presentations. Its client-side agent is only about 150 KB in size. The product is an excellent tool for broadcasting corporate news via TV monitors located throughout a company.

## RemoteWare Express 1.2

The Software Manager component of RemoteWare Express is an excellent tool for distributing programs and data, especially for remote clients not permanently connected to a network. Lacking IP Multicast capabilities, it's much slower than Multicast and Rendezvous. But it supports incremental updates, as well as compression to reduce bandwidth usage.

*continued*

Software Manager installed new software, updated old files, and delivered new templates and support files over a variety of different connections, including ISP-based Internet accounts and direct dial-up. The package is reliable, but we found Castanet and BackWeb InfoCenter easier to administer. We used RemoteWare Express's secure software distribution, using the Microsoft Crypto API and the default RSA algorithm.

The product let us schedule automatic downloads when users accessed our lab-based Web site, and we could also initiate transfers manually via a browser-based interface. The software staged pending transfer material on an intermediate server, which queued software-distribution transactions to be released whenever a remote dial-up user connected to the network.

On a set schedule, the product faithfully ensured the updating of all our clients. The Session Manager let us characterize and organize our clients by dial-up or persistent connection. We developed session scripts to automate the delivery of program and data files, which let us take a hands-off approach to data distribution.

An organization with many temporarily off-line mobile clients will find RemoteWare Express a good solution for its data-distribution problems.

## Rendezvous 4.2

An impressive, well-crafted data-distribution tool that runs on multiple platforms, Rendezvous's programming interface is based on a publish/subscribe metaphor. Incorporating data transfer into an application was easy and painless. Tibco's subject addressing, via its Subject Name Server (SNS), is rooted in the LDAP standard. With SNS, we established several subjects and then programmed clients to filter and organize multicast data by subject and area of interest.

SNS helped us narrow the focus of the information each client application had to deal with. As we published data, Rendezvous treated our updates as events with subject labels in which subscribers (i.e., clients) registered an interest. The Rendezvous infrastructure delivered newly generated events to interested clients, which didn't have to poll for updates.

While not as fast as StarBurst Multicast, Rendezvous is about half the price. Like Multicast, Rendezvous used both broadcast and IP Multicast protocols to deliver information to our clients. It switched as needed between protocols to ensure reliable receipt at each client, and it used distributed queues for one-of-*n* delivery.

The product's C/C++ and Java interfaces are both small (under 100 Kb). We particularly liked its thread-safe, multiprocessor-safe design, which let us create complex applications without worrying about push middleware limitations. Also, Rendezvous handled data-format translation among various platforms and could dynamically replace application components, such as DLLs, ActiveX processes, and Java classes.

Rendezvous is especially suited for keeping files up to date in vertical market applications containing volatile data that administrators must periodically refresh.

## Wayfarer 4.0

Our beta copy of Wayfarer (formerly INCISA) did an excellent job of securely broadcasting news, updated Web page alerts, and, via its DataBridge module, application alerts (i.e., notifications of specific activity or database conditions that warranted action). It authenticated and encrypted data transmissions via RSA's RC4 encryption standard. In contrast to Multicast and Rendevous, however, Wayfarer transferred data relatively slowly.

The product accepted alerts from Web-based public information sources and internal corporate applications alike. We programmed the latter type of alert by simulating an inventory database with SQL Server and using Wayfarer's programming interface to generate alerts.

Tying Wayfarer to our database in rather simple ways, we got instant notifications of inventory problems. We only needed to place application-specific data in two Wayfarer tables specially designed for Wayfarer headline creation. Thereafter, Wayfarer did the work of noting new or changed table rows and alerting us with HTML messages that appeared in the form of browser headlines on selected client screens.

We created Wayfarer groups for the different classes of clients on our network and then placed each client in a group. Each group of clients received a particular feed of Wayfarer-pushed content; clients in multiple groups received several feeds. Wayfarer distinguishes between private and public groups, and only administrators can authorize access to a private Wayfarer group. In short, Wayfarer is an excellent, inexpensive Webcasting tool.

## Getting Pushy?

StarBurst Multicast pushed its way to the front of the competition with ease despite its high price, frugally using our network bandwidth via its IP Multicast implementation and letting us distribute many different kinds of content. Close behind, Tibco's Rendezvous was an easy-to-program data courier that also used IP Multicast.

StarBurst Multicast is not an inexpensive tool, but it excelled at distributing content on our network. A company large enough to need safe, quick data distribution should have no problem recovering its investment in this product. B

*Barry Nance (Wethersfield, CT) is a BYTE consulting editor. You can reach him by sending e-mail to* **barryn@erols.com.**

### PRODUCT INFORMATION

**BackWeb InfoCenter 4.0**
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800-863-0100
408-933-1700
http://www.backweb.com
Enter HotBYTEs No. 1049.

**Castanet 2.1**
$995 and up
Marimba, Inc.
Mountain View, CA
650-930-5282
http://www.marimba.com
Enter HotBYTEs No. 1050.

**Cyberprise Server 2.0**
$25,000
Wall Data, Inc.
Kirkland, WA
888-786-2268
425-814-9255
http://www.cyberprise.com
Enter HotBYTEs No. 1051.

**Netpresenter 3.0**
$799 for one developer plus 20 users
Netpresenter B.V.
San Jose, CA
408-490-2857
http://www.netpresenter.com
Enter HotBYTEs No. 1052.

**RemoteWare Express 1.2**
$5000 for 100 users
XcelleNet, Inc.
Atlanta, GA
770-804-8100
http://www.xcellenet.com
Enter HotBYTEs No. 1053.

**Rendezvous 4.2**
$600 per client; $2500 per developer
Tibco, Inc.
Palo Alto, CA
650-846-5000
http://www.tibco.com
Enter HotBYTEs No. 1054.

**StarBurst Multicast 3.03**
$39,900 for a single-server, 25-client license
StarBurst Communications
Concord, MA
978-287-5560
http://www.starburstcom.com
Enter HotBYTEs No. 1055.

**Wayfarer 4.0**
$5000 for 100 users
Wayfarer Communications, Inc.
Mountain View, CA
800-300-8559
650-426-2000
http://www.wayfarer.com
Enter HotBYTEs No. 1056.

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*We compare eight of the latest palm-style and keyboard-based hand-helds from Casio, HP, Sharp, and others.* ***By Michelle Campanale and David Essex***

# Computing Out of Your Palm

Much has changed since BYTE last rounded up hand-held computers (in August 1997). Color screens are available, and Microsoft has upgraded its groundbreaking Windows CE OS with better PC synchronization, more standardized development tools, and support for color screens.

But the big news in hand-helds is Microsoft's entry into the realm of palm-style devices pioneered by U.S. Robotics (now a 3Com company) and its PalmPilot organizer. Microsoft's Windows CE 2.0 for Palm PC (version 1.0) opens the palm form factor to outside vendors, challenging 3Com's lock on the market and extending the platform's capabilities.

BYTE gathered the first Windows CE palm devices and compared them to the newest 3Com organizer, the Palm III. We also compared Windows CE 2.0 keyboard-based hand-helds to each other and to the proprietary Psion Series 5 hand-held. Using both subjective and objective criteria, we assigned ratings in three areas (see the chart below).

We didn't perform rigorous battery tests, but we found vendors' battery-life estimates (20 to 30 hours) to be roughly accurate. These numbers actually matter less than you might think. With rechargeable batteries and AC adapter/chargers becoming standard on keyboard units (and starting to show up on palm PCs), it's easy to run them from AC power in your office. (The exceptions are color hand-helds, which last 3 to 5 hours per recharge—less if you have a PC Card.)



**Hand-held PCs break down neatly into two categories: palm-size organizers, such as the PalmPilot, and more fully functional keyboard-based units, such as the Psion Series 5 and HP 620 LX.**

The BYTE Best winner in the three-product palm category was Casio's Cassiopeia E-10, which bested the Everex Freestyle and the Palm III with its brighter screen and better ergonomics. The color Sharp Mobilon was tops among five in the keyboard-based group, overcoming its steep price with a great screen, optional digital camera, good ergonomics, and the most attractive industrial design.

In the palm category, check out the Windows CE–based units. We believe their added functionality is a plus over the Palm III, with no immediately apparent negatives.

## Casio Cassiopeia E-10

The Cassiopeia E-10 shows the benefits of Casio's long experience in the electronic-organizer business. It's a good value at $399, and it includes global-find and voice-command software.

We found the E-10 the easiest to use of the Windows CE 2.0 palm devices. It has well-placed buttons for controlling the

| RATINGS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Casio Cassiopeia E-10** B | Everex Freestyle | HP 620 LX | LG Phenom | Philips Velo 500 | Psion Series 5 | **Sharp Mobilon HC-4500** B | 3Com Palm III |
| **TECHNOLOGY** | ★★★★ | ★★★★ | ★★★★ | ★★★★ | ★★★★ | ★★★★ | ★★★★★ | ★★★★ |
| **IMPLEMENTATION** | ★★★★ | ★★★ | ★★★★ | ★★★ | ★★★★ | ★★★ | ★★★★ | ★★★ |
| **PERFORMANCE** | ★★★★ | ★★★★ | ★★★★ | ★★★ | ★★★ | ★★★★★ | ★★★ | N/A |

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

PHOTOGRAPH: STEVEN GREENBERG © 1998

device with the same hand you hold it with.

The E-10 is easy to read, thanks to its backlit 240- by 320-pixel screen, which has high contrast and low glare. It includes 4 MB of ROM and is upgradable to 8 MB to facilitate future versions of Windows CE. You can't upgrade beyond the E-10's standard 4 MB of RAM, but its Type 2 Compact Flash slot supports both memory (for added expansion) and I/O. One drawback: The opened battery slot exposes a small corner of the circuitry to dust and dirt.

## Everex Freestyle

Like the Cassiopeia E-10, the $399 Freestyle runs Windows CE 2.0 and is a high-end organizer and business-productivity device rolled into one. It comes with 8 MB of RAM and 8 MB of ROM—twice what is typical for a palm device. The Freestyle also ships with rechargeable AAA batteries and an AC adapter/recharger, still an unusual feature in palm-style units.

But there's a learning curve for the Freestyle. There are too many buttons, and they're located at the spot where you hold the device, so it's easy to accidentally press a key. And although the Freestyle has a high-resolution screen, its contrast is weak and the display is dull compared to the displays of the Palm III and, especially, the Cassiopeia E-10, which has a crisp monochrome display.

## Hewlett-Packard 620LX

One of the first things you notice about the $849 HP 620 LX is its James Bond–like pen ejector, which literally fires out the metal stylus at the push of a button. But don't be fooled; the 620 LX is built for business. It ships with Quicken Expense software, unique among the group.

The 256-color screen is second only to the LG Phenom's in size. We found it to be bright and readable, with good contrast. Unlike the other keyboard-based units, the 620 LX's screen is always backlit.

You can buy an optional ($119) VGA PC Card to show PowerPoint files through a monitor or LCD projector, but the projected characters are too jagged to use for a real presentation. And we found the 620 LX's slanted chiclet-style keys, though more widely spaced than on previous HP hand-helds, are still not easy to type with.

If color is what you want, you can't ignore the 620 LX. It's $150 cheaper than the Sharp Mobilon, but it loses points in all comparisons of keyboard comfort, pocketability, and overall design.

**TECH FOCUS: PROCESSORS**

### Making the Most of a Tiny Space

**A hand-held computer's overall throughput depends on memory handling, how the display is cached away, and the efficiency of the CPU. The Cassiopeia E-10 palm device, for example, has relatively fast data-transfer times (see the table on page 106) because Casio's engineers doubled the amount of memory cache for the unit's NEC VR4111 Mips processor.**

**Chip vendors say there are a variety of tweaks and optimizations that OEMs can make on the basic core processor to obtain better performance, better power consumption, or lower cost. For example, to keep costs down, a vendor might leave out fast infrared, high-speed data buses, or digital protocols for wireless LAN, even though a chip set might have those capabilities. The focus is squarely on getting such peripheral features down to a manageable group and then porting them to small-geometry chips.**

**By this fall, the typical peripheral set will likely expand to include 56K modems, universal serial bus (USB), and smartcards, according to Philips's Semiconductor Division. But because chip manufacturers want to leverage processor volume, they are apt to continue allowing OEMs to take out features they don't think their target market wants or needs.**

## LG Phenom

In many ways, the Phenom is a monochrome knockoff of the HP 620 LX. It's nearly identical in width and thickness, tying with the HP for widest keyboard. The result is the most comfortable touch-typing, although its well-spaced keys are small.

VGA output comes standard with the unit, a unique feature among the five keyboard-based units. The port requires an included adapter cord, but it doesn't use a PC Card like the HP 620 LX does, so that slot on the Phenom remains free. A built-in modem also comes standard.

The unit's 18-square-inch screen is the biggest of the group, but when we attempted to press a screen button in the world clock, a nearby permanent-contrast icon was activated instead.

Our other complaint about the Phenom is its cheap appearance. It lacks the solid metallic feel of the Philips Velo 500 and the Sharp Mobilon. It's also plain-looking and seems more likely to break. The Phenom is a decent enough hand-held, but we wouldn't choose it over the Philips, the Sharp, or the HP that it imitates.

## Philips Velo 500

The Velo 500, successor to the Velo, packs more of what counts into the same-size form factor. The black-and-white screen is now the industry-standard 640 by 240 pixels, the CPU clock speed has doubled to 75 MHz, RAM now starts at 16 MB (expandable to 24 MB), and the modem runs at a faster 28.8 Kbps.

The Velo 500 has 10 dedicated keys for launching applications, three more than the Mobilon (although the other keyboard-based hand-helds each have a few permanent icons taped onto the bottoms of their screens). Another differentiator is the AllPen Mobile Forms Database, which seems similar to the Series 5's database.

One of the few things we didn't like about the Velo 500 was its small oval keys. They're spaced similarly to those of the other hand-helds, so the feel is likewise scrunched, but we think larger keys would have raised our word-per-minute count.

The Velo is no longer a standout. However, its solid feel, small size, decent usability, and midrange price of $639 make it one of the best buys.

## Psion Series 5

Although it's been out for over a year, the Series 5 from Psion remains competitive. It performed data transfers up to four times as fast as the other systems in our tests. Psion upgraded its EPOC OS to 32 bits last year. Combine this with the Series 5's near-full-size keys and Psion's already-long list of supported file formats, and the result is functionality that approaches that of the Windows CE units.

The keyboard is what most differentiates the Series 5 from its successful predecessor, the Series 3. The large keys have almost no space between them, and their total width is the same as on the other hand-helds, so touch-typing remains a chore. We did notice a slight improvement in typing speed, however.

The Series 5's usability is hurt by the screen's default character set, which is sometimes small and hard to read. The backlighting is only average.

File import and synchronization are where the Psion really blows away its com-



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petitors. The PsiWin 2.1 software lets you swap data among the Series 5's proprietary office applications and more than three dozen past and current members of the Corel, Lotus, and Microsoft office suites.

On the other hand, the Series 5 is lacking in communications hardware. Most of its fax, data, and Web features are optional extras, and there's no docking station.

Although it remains a competitor on a technical basis, the Series 5 has fallen behind the others in the value it provides. The $599 base unit comes with only 4 MB of RAM; the more directly comparable 8-MB unit—still below the 16-MB average, like the LG Phenom—costs $699, hardly a great buy for a monochrome hand-held.

Psion's EPOC32 OS and its OPL language have excellent development tools, which we've favorably reviewed in the past. We doubt, though, that anyone without a previous commitment to the platform will choose it over Windows CE 2.0.

## Performance Matters

Casio's Cassiopeia E-10 was the fastest palm device (barely), while the Psion Series 5 led the keyboard-based group.

| | 180 KB from laptop | 360 KB from laptop | 180 KB from hand-held | 360 KB from hand-held | Synchronize two files |
|---|---|---|---|---|---|
| **Casio Cassiopeia E-10** | 37.5 | 71 | 89 | 176.5 | 57.5 |
| **Everex Freestyle** | 37.5 | 71.5 | 89.5 | 178.5 | 57 |
| **HP 620 LX** | 37.5 | 73.5 | 91.5 | 182.5 | 57 |
| **LG Phenom** | 43 | 72.5 | 98.5 | 194 | 60 |
| **Philips Velo 500** | 46.5 | 88 | 92 | 183.5 | 84 |
| **Psion Series 5** | 14 | 25 | 17.5 | 28 | N/A[1] |
| **Sharp Mobilon HC-4500** | 47 | 86.5 | 87.5 | 166.5 | 83.25 |
| **3Com Palm III** | N/A[2] | N/A | N/A | N/A | 72[3] |

Numbers reflect average serial data-transfer times (in seconds).

[1] The Series 5 could not complete all tests, such as synchronization of two Microsoft Word files. Psion does not allow this function because there's a risk of accidentally deleting a file.

[2] The Palm III could not complete all tests, such as file transfer of a Microsoft Word document.

[3] Timing was done after converting the file to text and importing to Palm Desktop Windows on the PC.

## Sharp Mobilon HC-4500

Sharp's entry is an early adopter's dream. The Mobilon is one of only two or three systems to come with a color screen (the HP 620 LX also has one) and, optionally, an amazingly small digital camera that runs off a PC Card. The Mobilon's metallic-looking case and almost-overdesigned look and feel scream techno-snob appeal.

Naturally, these bleeding-edge features come at a price. The Mobilon lists for $999, $150 more than the HP 620 LX and $300 to $400 more than a typical black-and-white hand-held. The camera costs $399, a high premium to pay for miniaturization.

Nevertheless, there's no denying that the Mobilon's color screen removes the squint factor from the hand-held PC experience. Furthermore, its usability is helped by the seven quick-start application keys. The keyboard has smallish alphanumeric keys that are more diminutive than those of most of the other hand-helds we reviewed. The result is the same, though, because typing comfort comes down to keyboard width, not key size.

We can't overlook another cost of color: battery life. While we didn't perform rigorous battery tests, we were able to go 2 to 3 hours per charge. Sharp says that the optional digital camera can drive battery life down to just 25 minutes.

## 3Com Palm III

We couldn't ignore 3Com's $390 Palm III, given the popularity of its predecessor, the PalmPilot Pro. The new unit includes such relatively minor changes as larger fonts, an infrared port, a more rugged plastic cover, a metal stylus, and a higher (though still low) RAM-upgrade limit of 2 MB.

The Palm III is the only hand-held in our roundup that comes backed by 24-hour technical support. We found it simple to use, with good documentation and tutorials. But the Palm III's greatest strengths might be its bounty of software and its stable OS, which refused to crash no matter what we threw at it.

Still, when compared to hand-helds running Windows CE 2.0 for Palm PC, the Palm III has limited robustness out of the box, and it's much less configurable. It also suffers from a lack of screen real estate. There's no sound recorder, unlike on the Casio and Everex systems, and the Palm III has limited sound output, which you need for alarms.

The bottom line: Out of the box, the Palm III is highly useful and affordable, but it needs some serious upgrading to compete with the more feature-rich palm-style organizers that run Windows CE. B

*Michelle Campanale is a BYTE technical editor based in San Mateo, California. David Essex is BYTE's director of reviews. You can contact them by sending e-mail to* **michelle.campanale@byte.com** *and* **david.essex@byte.com**, *respectively.*

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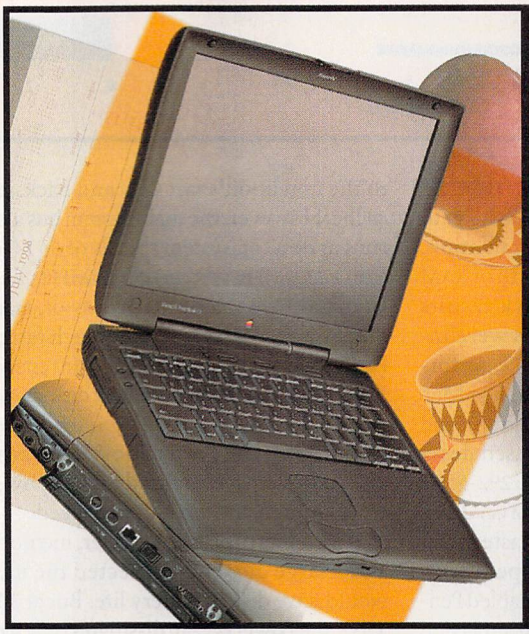
*Apple's latest notebook computer combines workstation performance with long battery life.* ***By Tom Thompson***

# The Most Powerful Notebook

Take a too-quick, too-casual glance at its specifications, and you might mistake Apple's second-generation Macintosh PowerBook G3 notebook for just another full-featured Wintel laptop. It's got all the expected attributes: a 2-inch thick black box (12.7 by 10.4 inches), large TFT screen, 233-MHz or faster processor, 32 MB of RAM, 2 GB or larger hard drive, ATI Rage LT video controller for 2-D and 3-D acceleration, 16-bit stereo sound I/O, 32-bit CardBus interface, VGA output for an external monitor, and an optional 56-Kbps K56flex internal modem.

But on closer inspection there's no mistaking this computer for anything but an Apple product. Its case is a subtle, curvaceous design that gives you two expansion bays for lithium-ion batteries or hot-swappable peripherals, such as a floppy drive, a CD-ROM or DVD-ROM drive, or a third-party Zip drive. But inside is where the PowerBook G3 really shines, with hardware that's optional on PC notebooks but standard fare for an Apple system. This includes a SCSI and a 10Base-T Ethernet interface, an RS-422 serial port, an Apple Desktop Bus (ADB) port, a 4-Mbps IrDA infrared port, and S-Video output port (on certain models). The PowerPC 750 processor (aka G3) delivers workstation-level performance while consuming little power, so this computer offers a claimed battery life of three hours. (For more on the PowerPC 750, see "First Look at PowerPC G3" in the April 1997 BYTE.) The top-end, 292-MHz version is the fastest notebook on the market.

| RATINGS | |
|---|---|
| TECHNOLOGY | ★★★★★ |
| IMPLEMENTATION | ★★★★ |
| PERFORMANCE | ★★★★★ |



**Macintosh PowerBook G3**
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**Computing muscle, big eyes, and a great body; Apple's new PowerBook G3 has it all.**

## Get What You Want

As with its new desktop computers, Apple has adopted a build-to-order strategy for the PowerBook G3. You can visit the online store (http://www.apple.com/store/) and select among nine basic configurations offering different processor speeds (233-, 250-, and 292-MHz); display type and size (an 800 by 600 12.3-inch SVGA STN screen or a 1024 by 768 XGA TFT screen in 13.3- or 14.1-inch sizes); display SGRAM (2- or 4-MB); and hard drive (2-, 4-, or 8-GB IDE). You can then customize this configuration by adding memory and choosing expansion-bay peripherals.

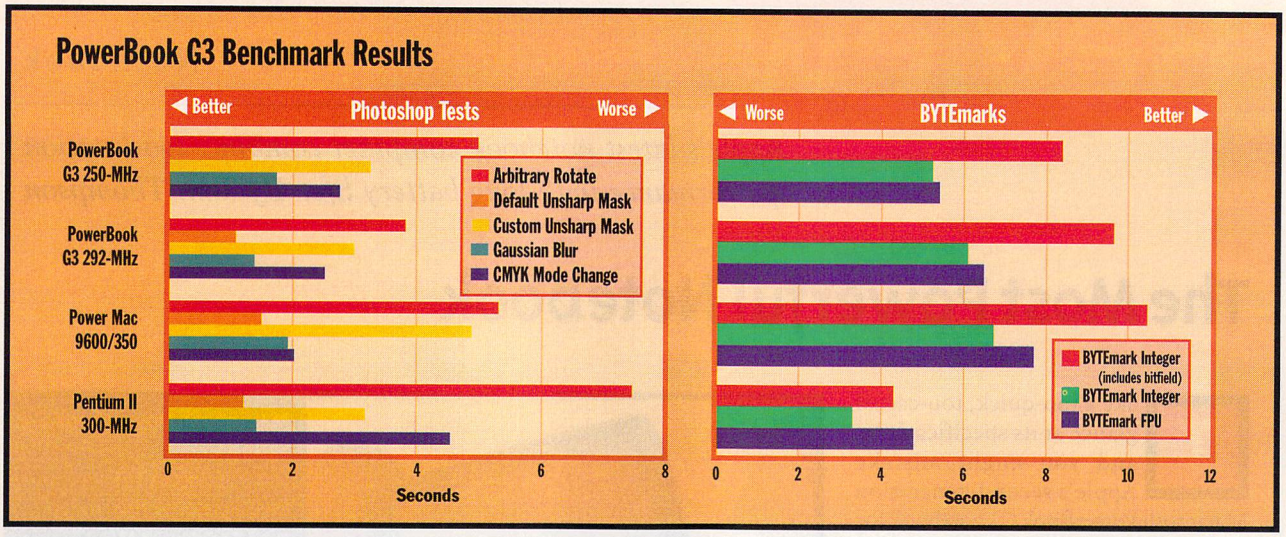
The PowerBook G3's modular design is what makes build-to-order possible. The PowerPC 750 (with any L2 cache) is on a plug-in daughtercard; a common case houses the different display sizes; the two low-power small-outline dual inline memory module (SODIMM) slots and the hard drive are easily accessible. These last two make it easy to add memory (up to 192 MB) and a specific size of hard drive.

It's not perfect. The PowerBook's 233-MHz configuration lacks any secondary (L2) cache. Thus, whenever the CPU has to fetch data from slower main memory, pipelines are stalled, which can hamper performance by as much as 40 percent. By contrast, the 250-MHz and 292-MHz processors pack a 1-MB backside L2 cache clocked at half the processor's rate.

A plastic tab holds the lid shut. Drop the notebook (almost inevitable in any laptop's lifetime) and this tab could shatter. The overall system design is otherwise very solid, so it's puzzling that Apple wouldn't use a sturdier sliding latch, as on the PowerBook 3400. Finally, at just over 7 pounds, this is no lightweight.

*continued*

PHOTOGRAPH: STEVEN GREENBERG © 1998




## Long-Lived Speed Demons

I received a 250-MHz PowerBook G3 with 90 MB of RAM for extended evaluation, and a 292-MHz model with 64 MB of RAM for benchmarking. BYTEmark results (above) show these machines were incredibly fast: The 292-MHz G3's performance approaches a 350-MHz Power Mac 9600 (a PowerPC 604e-based desktop), and it easily outguns Pentium II-based desktops. In our Photoshop tests, the 292-MHz system was as fast as a 300-MHz G3 desktop system (no surprise) and faster than the Power Mac 9600 on some operations. It also bests a 300-MHz MMX-enabled Pentium II on certain tests. This speed is due to the notebook's fast CPU and backside cache. However, the main system bus also runs at desktop system speeds of 66 MHz (for a 233-MHz system) or 83 MHz. This lets data move among the processor, main memory and I/O subsystems much faster. But remember: The memory-intensive Photoshop test does not reflect disk speed. The Power Mac 9660/350 should be faster overall than the PowerBook G3, whose disk subsystem is optimized for low power consumption and weight, not speed.

With all its processing power, memory, and a large display, I expected the unit would have dismal battery life. But at 300 MHz, the PowerPC 750 dissipates only 4 to 7 watts in normal operation. I used the system for my normal day-to-day work with a medley of applications and easily got 2 hours of battery life. This is a worst-case scenario, since I worked the system *hard*: The 13.3-inch screen was on maximum brightness, the notebook never went to sleep, and I did frequent saves to the internal disk, followed by backups to a server via Ethernet or to a Hitachi 260-MB hard drive PC Card. If you can tolerate a dimmer screen and don't do much on-line work, it should be easy to get 3 hours of battery life. Furthermore, you can put another battery in the second bay and double the work life. The ADB port lets you easily add an external keyboard and mouse, and the CardBus slots support Zoomed Video and ISDN adapters if you want the notebook to fill in as an office computer.

## Portable Desktop

We found no surprises in software compatibility. Microsoft Office 98, Adobe Acrobat, Illustrator, and Photoshop, Qualcomm's Eudora e-mailer, Lotus ccMail, and Netscape Communicator all worked fine, as did older programs such as CE Software's Widgets (a laser-printer utility circa 1987) and Claris's MacWrite Pro (circa 1993).

The latest PowerBook G3 is more powerful than many desktops, Mac or PC. With the system's no-compromise capabilities, most folks will shrug off its heft. And for the many users who want, or need, to use a Macintosh on the road, the PowerBook G3 is a prayer answered. B

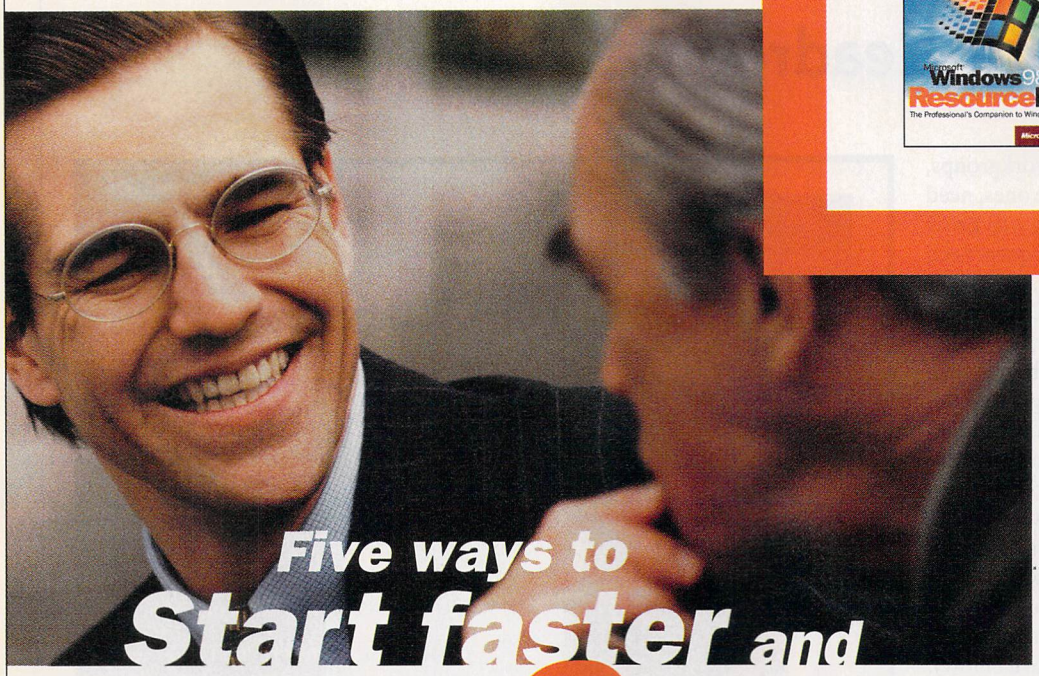
*Tom Thompson* (**tom.thompson@byte.com**) *a BYTE senior technical editor at large, has covered the Macintosh for many years.*

**TECH FOCUS NETWORKING**

### If It's Tuesday, This Must Be Lexington

**The one thing that can drive you nuts when you shuttle between two offices and home is trying to get hooked into the printers and servers at each location's network. Fortunately, the Mac OS has two weapons that battle this problem: Open Transport and the Location Manager. Open Transport is the Mac OS's low-level network infrastructure for both AppleTalk and TCP/IP network stacks. You store the settings for each stack (perhaps TCP/IP gets an IP address from a DHCP sever when in BYTE's Peterborough office, has a fixed IP address in the Lexington headquarters, and uses a PPP stack at home) as named objects (Peterborough, Lexington, and Home). Most important, Open Transport can modify these protocol stacks on the fly—without rebooting the computer.**

**The Location Manager lets you invoke a group of same-named objects that store a location's settings. With a pick from a pop-up menu, the PowerBook's network stack, default printer, time zone, sound level, file-sharing state, and other settings are changed automatically. A window summarizes whether each setting was changed successfully or not. When I leave for a different location, I simply put the PowerBook to sleep (No, Virginia, I do not like watching my computer boot). Once I arrive, I wake the machine up, plug in the network cables, pick the current location from the menu, and go to work. Aliases for server directories (such as one for completed manuscripts) let me copy files by simply dragging and dropping icons. Open Transport and the Location Manager manage the gritty low-level details of the network sessions so that the drag-and-drop operation works, regardless of where I am.**




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*The PowerEdge 2300 shows Dell is serious about building scalable servers. By Barry Nance*

# A Server with Headroom

Rapidly growing workgroups, especially remote ones, need a file server that will grow with them. The frequent need to replace or upgrade hardware is a hidden cost you want to avoid. Dell's third-generation server, the PowerEdge 2300, has the headroom to support burgeoning workgroups without bogging down.

The machine's 400-MHz dual Pentium II CPUs let me smoothly increase the server work load from a simulated 50 users to 200 with little change in individual user-response times. Its I/O subsystem delivered each user's data at a rapid, linearly increasing rate as I stepped up the simulated user population through 50, 100, and 200 log-ons (see the figure below). The Pentium IIs turned in a respectable 5.90 in the BYTEmark Integer test.

The 2300 impressed me with its logical layout and easily accessed parts. The unit I tested had six 4-GB hard drives, but Dell also offers 9-GB drives. The 2300's I/O subsystem consists of Ultra Wide SCSI disks configured for RAID 5, a RAID controller with a 32-MB cache, and two Intel 10/100 Pro/B network adapters, which I exercised at 100 MBps. Dell says that, by the time you read this article, the 2300 will also offer a low-voltage differential (LVD) Ultra2 hard drive controller.

The 2300 supports one or two Pentium IIs running at 333, 350, or 400 MHz, with 512 KB of internal L2 cache operating at one-half the rated CPU speed. The 100-MHz system-bus speed reduces I/O bottlenecks by getting data, including non-cached bytes from RAM, to and from the CPU quickly. Dell uses 100-MHz ECC SDRAM DIMMs for added speed.

In addition to the LVD interface, other features that Dell promises to add to the 2300 by mid- to late summer include a 1-GB RAM option and remote administration through a Dell Remote Assistant Card (DRAC II). The DRAC II will, Dell says, permit dial-in and over-the-network diagnostics and troubleshooting.

This evaluation convinced me that Dell is getting serious about servers. The 2300 is a superb file server that workgroups won't quickly outgrow. B

*Barry Nance (Wethersfield, CT) is a BYTE consulting editor. You can reach him by sending e-mail to* **barryn@erols.com.**



**PowerEdge 2300**
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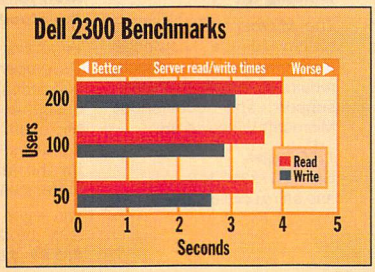
**Adding memory, adapters, and drives to the 2300 is a simple task.**

| RATINGS | |
|---|---|
| TECHNOLOGY | ★ ★ ★ ★ |
| IMPLEMENTATION | ★ ★ ★ ★ |
| PERFORMANCE | ★ ★ ★ ★ ★ |

## TECH FOCUS BENCHMARKS

### Fast CPUs Mean More Users

**The speed of a file server's I/O components governs the response times for each client, while CPU speed governs the number of concurrent clients the server can support. Saturate a slow-CPU server, and response times balloon. I/O components still operate at the same speed, but the CPU cannot trigger enough cycles per interval to give all users acceptable response times. Greater CPU speed means more users.**




**The NETFIO benchmarks time file-read and file-write operations.**

PHOTOGRAPH: STEVEN GREENBERG © 1998



★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

Jerry Pournelle

# Chaos Manor



## The Days of Ninety-Eight

*Windows 98, that is. Jerry makes the trek to WinHEC, and Fireball gets a case of the 98 blues.*

I don't normally lead my column with a utility, but I have to say some nice things about Symantec's Norton Utilities for Windows 95. This is version 3.0, and it does wonders.

It all started when Compaq sent me an updated Armada laptop, which I dubbed Royal Armadillo. This one is the 4220T, with a 266-MHz Pentium Processor, which, until I got the new Intergraph TDZ P-II/300, was the fastest single-processor machine in the house. The 4220T came with Windows 95b (OSR2) and a new 56-Kbps PC Card modem. What it did not come with was a new docking station. When I docked Royal Armadillo to get him on my network, I had to install drivers, and I managed to mess things up.

It wasn't Compaq's fault. Prior to that fiasco, I had done something else that caused me to reinstall Windows 95b on the machine; that may well have caused my subsequent problems.

Worse, we were in a big hurry. Alex was due to catch a plane to Hannover, Germany, where he was to produce the BYTE Best of CeBIT Awards show, using this new laptop to control the projector and in general to run the presentation.

The problem was compounded by electronic-camera software. Olympus cameras come with Adobe PhotoDeluxe, while Agfa cameras come with Agfa's Photowise. Both programs work, but they hate each other. Install both on the same machine, and it's quite possible that neither will work. Since the Agfa camera has a zoom and none of my Olympus cameras did at that time, Alex wanted to borrow one of each.

Discussions with Agfa engineer Lisa de Bettencourt revealed that the Agfa camera at first shipped with PhotoDeluxe and they hadn't changed TWAIN drivers. This meant that both cameras would work with PhotoDeluxe; even better, both worked with Photoshop, and in fact that was what Alex used to produce the show. It worked just fine, and I'm told the show was a great success.

However, by the time we had all that working, it was time to go, and Alex reported that Royal Armadillo behaved rather oddly on the road. He'd get blue screens at unexpected times, and the sleep software wasn't well behaved. There were other annoyances.

After Alex brought it home, I docked the machine. It fought with docking drivers and generally had problems. Then Scandisk reported disk problems and couldn't fix them, because every time it would try, something would interrupt. Figuring enough was enough, I got out Norton Utilities and installed that.

**Ten minutes later, Norton Utilities reported 28 "severe" problems.**

Norton Utilities fixed the disk problem and then reported general unhappiness. I told it to do a full system diagnosis. Ten minutes later, it reported 28 "severe" problems, all software and registry troubles: conflicting DLLs, incorrect shared-resource software, and misplaced system files. I was afraid I'd have to scrub down to bare wood, but for a lark, I told Norton to fix the problems.

Five minutes later, Royal Armadillo was running just fine. Norton reported all problems fixed. The docking station and networking work just fine, the machine suspends and sleeps as it should, and I haven't had a blue screen since. I rather liked Norton Utilities from the start, but version 3.0 is a genuine improvement over the earlier versions. It may not be the registry cleaner I asked for in a previous column, but it's getting there.

There's also a new feature, Zip Rescue, which works if and only if you have a Zip drive (IDE, parallel, or SCSI) installed. With this you create a pair of rescue disks, one Zip and one floppy. The Zip disk will be completely filled with rescue information; the floppy disk will know how to reach the Zip drive. Now you can boot with the floppy disk, and the system will come up in Windows 95, not in DOS. The registry will be restored as of the last time you made a rescue disk, and Bob's your uncle. I've tried this, it works, and it's sure a superior way to recover.

Iomega now has a new internal IDE/ATAPI Zip drive. I installed one as a slave to the CD-ROM drive on one of my systems. The hardware installation took about 10 minutes. The software comes on a CD-ROM and takes a minute, after which your system knows this is a Zip drive, and Norton Utilities knows how to create a Zip Rescue. That's wonderful.

Some warnings. Mijenix's FreeSpace and Norton Utilities hate each other. Don't use both. While I'm at it, let me warn you again: do not use FreeSpace or any other compression program on critical files. Use compression programs to temporarily make space prior to cleaning up, as for instance, when you're on an airplane and you want to make room for a game. Compress the game and move it to another system when you get home.

Buy a Zip drive. You need one for Zip

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Rescue anyway, and there's a new combination parallel and SCSI ZipPlus drive that's really nifty. Get a SyQuest SparQ or SyJet. Whatever, but don't rely on file compression for the long term. On-the-fly compression is a good temporary measure, but it's the long-term solution to nothing.

Second warning: Steve Sussman of Syncronys Softcorp tells me that you can have difficulties with Norton SpeedStart. SpeedStart is a way to cache DLLs and virtual device drivers (VXDs) and the like so that programs start faster. If you have problems with it, turn it off; the rest of Norton Utilities will work just fine.

Norton will natter at you about updates. When you try getting the updates, it will really work on you to subscribe to their update service at 40 bucks a year. Apparently, maintenance updates are free, but they want you to pay for improvements. Even after you get the free update, it will complain that you haven't bought the subscription service. Feh.

Norton Utilities isn't bug-free, and it can natter at you at the wrong times, but I still find it invaluable. Recommended.

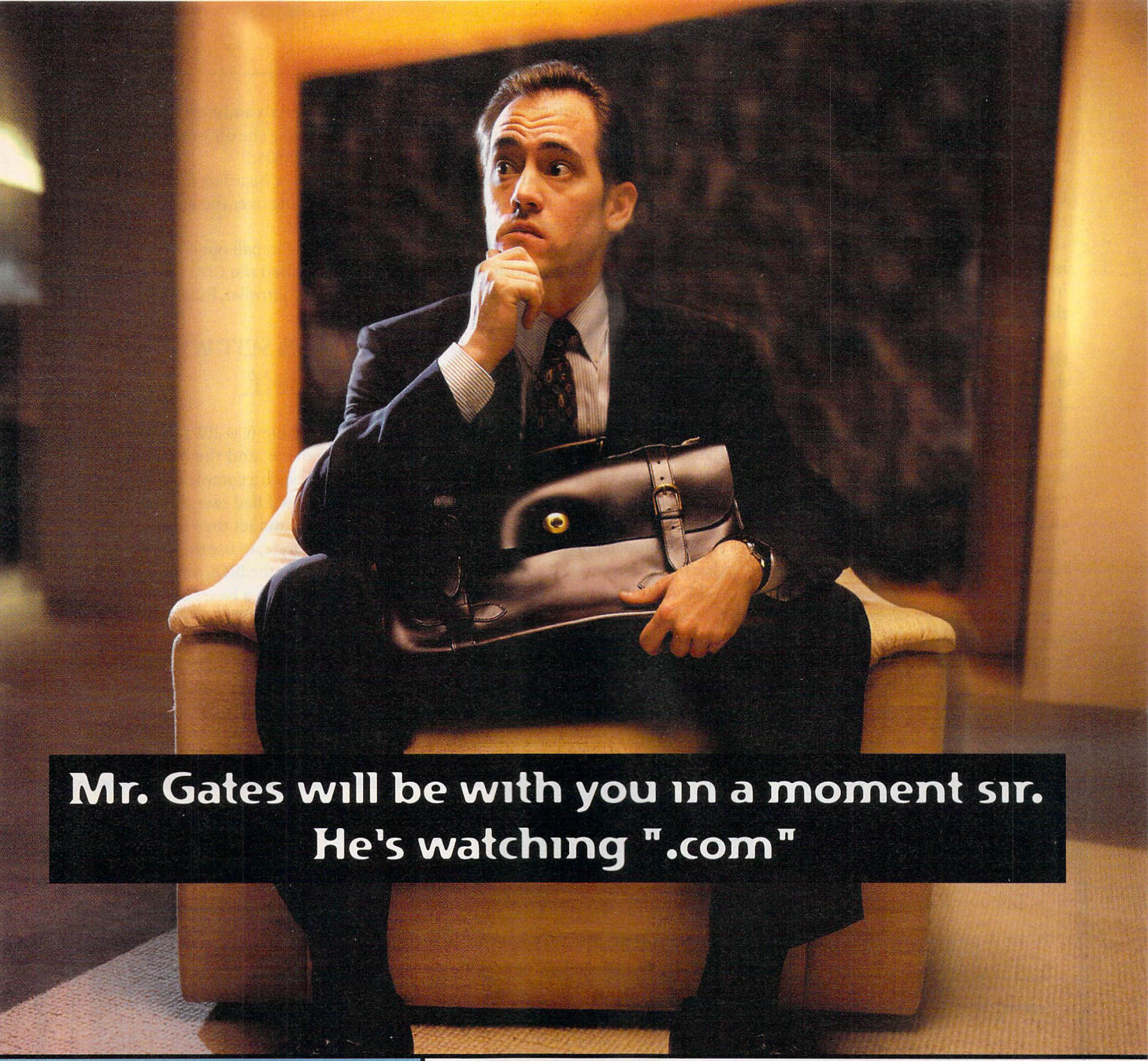
WE JUST SURVIVED A DISASTER. The original lead for this column was to be the installation of Microsoft BackOffice Small Business Server on Fireball. That's the big dual Pentium Pro 200 I built from a Micronics W6-LI motherboard and a Distributed Processing Technology (DPT) SCSI RAID controller. Fireball was running OSR2 quite nicely, but of course that doesn't make use of the second Pentium Pro.

Fireball was designed to be an NT server, and it was time. However, just then I went to WinHEC, where they distributed a release candidate (numbered "zero," of all things) of Windows 98. In an evil moment, I decided to install Windows 98 on Fireball before repartitioning him for NT 4 BackOffice Small Business Server.

Understand, there was no real need to do this. My notion for Fireball is a 150-MB file allocation table (FAT) partition for Windows 95, a 200-MB FAT partition for the NT system files, and the rest of the system partitioned for NT File System (NTFS). Windows 95 is a convenience: install new hardware, let Windows 95 Plug and Play deal with it, and if it works, you have the settings to feed NT when you install it there.

My only reason for installing Windows 98 was to see if it worked.

*continued*




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It didn't. Worse, after the attempt to install Windows 98, we couldn't even get the system to boot properly in DOS. It kept insisting that there was no CD-ROM drive. Once in a while, it would boot up with the CD-ROM drive working, but the instant you rebooted, that drive would vanish. Sometimes the system would hang up in DOS when CONFIG.SYS tried to install the CD-ROM driver.

I suspected the CD-ROM drive, the Teac CD-C68E six-drive changer; but changing drives did no good at all, while the Teac drive worked just fine in another machine. Clearly, something was screwy with Fireball himself. After three days of fussing about changing cables, changing drives, removing complexities from the machine, and generally wasting time, I was ready to retire the machine on the theory that the IDE controller chip in the motherboard had gone south.

At this point—by sheer coincidence—Maurice Hamoy and Steve Sussman of Syncronys Softcorp came over to show me the new version of BigDisk, a program that fools your system into thinking that the C drive is as large as you would like it to be. BigDisk puts files on other drives on your machine or, under Windows 95, will put them out to disk drives on your network.

You want to be careful what you put out on the network—clearly, you can't put network access software out there!—but BigDisk recognizes some critical software and lets you specify other files as protected from relocation. It's reliable and safe. I've tried to blow it up, but the worst that happens is that I have to bring some program files back from across the network. All told, it's a great way to make more disk space without having to reinstall software that thinks it is on the C drive.

**Clearly, something was screwy with Fireball himself.**

More on BigDisk another time. After they showed me the latest version, I told them of my problems with Fireball.

"I know just what's doing that," Steve said. "Windows 98 tries to install new IDE drivers, but with some systems, it doesn't do that properly and ends up altering your BIOS settings. The only remedy is to reset the system BIOS."

I had never heard of such a thing. Programs writing over the BIOS drivers? But he was right.

I hauled Fireball out of the back room and reinstalled the CD-ROM drive, DPT SCSI RAID controller, Ricoh MediaMaster CD Rewritable (CD-RW) drive, internal IDE Zip drive, and the other stuff that makes this such a complex (and valuable) system. Now I had two choices: pull the battery out and let the volatile BIOS settings evaporate, or use the software Reset BIOS entry in the BIOS setting. (On some systems, there's a Reset BIOS jumper on the motherboard.)

I chose the software route. Then I went into Setup to tell the BIOS that the primary IDE drive supported a CD-ROM master and to automatically detect the slave; and


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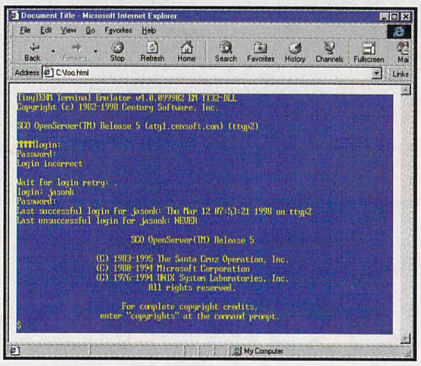
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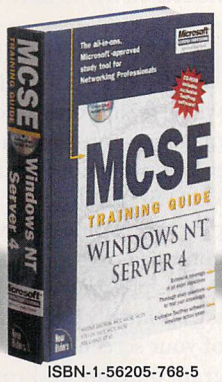

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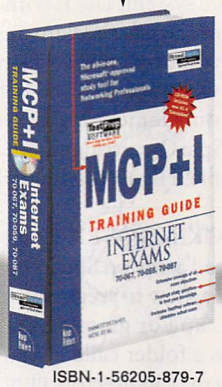
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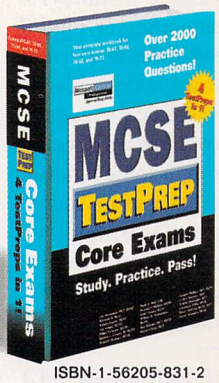
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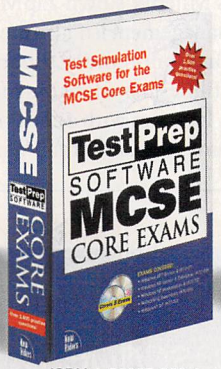

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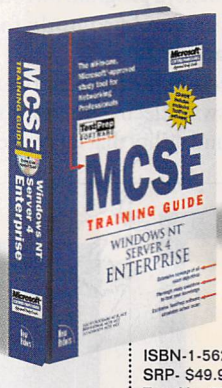

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booted in DOS. Now it saw the CD-ROM drive just fine. I used that to reinstall OSR2. An hour later, Fireball was able to see six hard drives, seven CD-ROM drives (six in the Teac drive plus the Ricoh MediaMaster), and an internal IDE Zip drive slave.

By then it was too late to install NT 4 BackOffice Small Business Server, but I'll get to that shortly. Meanwhile, this adventure confirms my mistrust in coincidence as an explanation. It was logical to assume that installing Windows 98 was the cause of my problem rather than some random chip failure; and, indeed, it was so. I never heard of a problem like this, but I've reported it to Microsoft. They are quite concerned, and I make no doubt they'll have it fixed by the time you read this.

ON STORAGE: LAST MONTH I spoke of the SyQuest SparQ 1-GB-cartridge drives for backup systems; they come in both external parallel and internal EIDE flavors. They're good all right; but if I were setting up a new system to act as server and backup station, I would install a SyQuest SyJet internal SCSI 1.5-GB-cartridge drive. There's also an external SCSI version.

Both work. They're fast, the drivers are small and well written, installation is a breeze, and in general I don't know of a more trouble-free removable-medium mass-storage system. Use it with PowerQuest Drive Image for backup or, for that matter, with the excellent backup program that comes with the SyJet, and Bob's your uncle. My only lament is that the SyJet can't read SparQ cartridges, but that's a minor quibble. Highly recommended.

I WAS LOOKING OVER THE 8 GB OF files stashed away on Spirit, my big NT server, with a view to seeing what I could archive to tape or glass disks, when I came across a folder called "American." Inside it was the subdirectory PRNTSCRN, which I vaguely recalled; and inside that was prntscrn.exe, a program I wrote about over a year ago and promptly forgot. I shouldn't have.

Print Screen, from the JE Software division of Janesway Electronics, is a little 300-KB background utility that lets you capture a .bmp image of whatever's on your screen or print a copy at the touch of the Print-Screen key. It works invisibly, it works well, and there's a new version out that supports more file formats. Sooner or later you're going to need this, and at 30 bucks, there's no reason not to have it. Recommended.

BEYOND PRINT SCREEN IS Mijenix's PowerDesk Utilities 98, which is supposed to do everything: file management, Zip management, screen printing (but not enabling the PrintScreen key), file finding, and a partridge in a pear tree. Some reviewers seem to have gone mad over it, perhaps rightly so.

This program does everything, including optionally putting a toolbar at the top of your screen that can launch any program on your desktop or in your start menu. Its Zip management is not as nifty as Mijenix's own ZipMagic, and the file management isn't (to me) as useful as Norton Commander. Even so, PowerDesk Utilities has a lot going for it.

It comes with a copy of QuickView, the same viewer that the Windows version of

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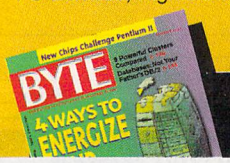
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Norton Commander uses. Alas, that's nowhere near as useful as the old DOS Commander's viewers. With DOS Commander, you hit F3 and you can view anything. This is why I keep a copy of DOS Commander installed on my desktop in addition to Symantec's Windows upgrade to Commander.

On the other hand, PowerDesk Utilities launches Notepad or another editor painlessly. You can set the keystroke commands to be like Commander or like XTree, for those who got used to those programs. I've installed the PowerDesk Utilities toolbar and haven't taken it down, and I suspect it's up to stay.

PowerDesk Utilities has an excellent file-finder capability, which will find files or search files by content. The interface with that isn't as smooth as I'd like, but when I want to find something, I am generally looking through a complicated system with a dozen networked drives and a tangle of subdirectories. There's probably no simple interface I would like. The PowerDesk finder does that job nicely.

Previously, I used Microlytics' GOfer, a DOS program from the long past that still works both locally and across networks, and remains good enough. Its only problem is a rather klunky no-mouse interface.

The PowerDesk Utilities toolbar automatically shows the text label for icons when you rest the cursor on them, but the version I have forgets how to do that sometimes. You can restore it by clicking on the toolbar properties and then closing that. I'm told there's a bug-fix update.

Mijenix is open to suggestions for improvements. I'd find it astonishing if you didn't manage to get a lot more than your money's worth out of PowerDesk Utilities 98. Recommended. I'm sure you'll find something useful there, and you may really fall in love with it.

WINHEC, THE WINDOWS HARDware Engineering Conference, was in Orlando, Florida, this year. It's a very technical conference, with some sessions over my head; but most are just about right for me. I learn more about what's coming in the year ahead at WinHEC than anywhere else. I also meet a lot of old friends and make some new ones. Because it's a technical conference, I meet the people who are doing the work, not just the PR people hired to talk about it.

I was unhappy but unsurprised to learn that the shipping date for NT 5 has slipped to sometime next year. It's a pity, because NT 5 will fix a number of NT 4 problems.

With improved Plug and Play, NT 5 will go a long way toward eliminating the need for any version of Windows 9x. (It will also make NT practical for laptops, because power management is organic to version 5.) They are working hard to make NT 5 a system suitable for all levels, from home offices to big corporations. Bill Gates said one major goal of NT 5 will be to reduce the total cost of ownership of PCs in general.

**I learn more about what's coming in the year ahead at WinHEC than anywhere else.**

My experience has been that NT 4 is good enough for home-office use—my experience with both workstations and servers has been very positive—but when you move to much larger installations, NT seems to have problems. Since I have little experience with big establishments—two servers and a dozen or so workstations is the largest system we've ever networked, and it's bigger than we need—I can only report what readers tell me about the high end of things.

Down at my level, NT 4 works, and it lets me network NT, both versions of Windows 95, an experimental Windows 98, and an old system running Windows 3.11. NT Workstation runs all my major software applications and most of my utilities, the only real limit being games; for those, I keep a good Windows 95 system.

From what I can see, the major new improvements of NT 5 over 4 (other than improved stability) will be in administrative tools. One of Gates's demonstrations involved replacing a dead workstation with a new computer. NT 5 network administration tools allow the restoration of all the productivity and utility software plus all the user files, so that the idle time for the workstation user is minimal.

While he was talking, Gates made a passing reference to Office 99. Given that Office 98 is a Mac product, and that the Service Release 1 version of Office 97 came out in January (it's the first version of it I've been willing to use), I suppose it's not surprising that there won't be a Windows

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version of Office 98. Also, given that the Mac Office 98 has improvements over Office 97, it's hardly astonishing that there will be an Office 99....

He also made references to speech recognition and text-to-speech capabilities. Given Microsoft's tendency to put such features directly into the OS, I'd think it obvious where that's going. (They appear to be working with Lernout & Hauspie, to whom BYTE has given well-deserved awards over the years for their speech-recognition products.) Also, Microsoft has formed an alliance with Silicon Graphics. This ought to lead to some spectacular graphics capabilities on desktop PCs.

ANOTHER TREND THAT CAN'T happen too soon is the move to USB, and beyond that to IEEE-1394 (alias FireWire, Apple's name for it; alias i.Link, Sony's name for it). For those who tuned in late, USB is universal serial bus, a 12-Mbps serial expansion bus that will let you add devices like keyboards, sound systems, joysticks and game controllers, microphones, and even small video cameras to your PC. IEEE-1394 starts at 100 Mbps and has plans to go to 2 GBps; it's designed for video and possibly disk I/O.

One important feature of USB and IEEE-1394 is they let you daisy chain devices while sharing a single interrupt. Another important feature is that all systems for the last year have come with USB connectors. My spies tell me that not all of those will work properly, but it's a good start.

On that subject, I sure wish that motherboard designers would add a jumper to let us hardware-disable the PS/2 mouse. As matters stand, the mouse wants interrupt request (IRQ) 12, which is a 16-bit interrupt, but it doesn't need it. Not only are USB mice coming fast (they gave us one as a party favor at WinHEC), but our present mice, including the popular Microsoft IntelliMouse, will work just as well on a serial port, and most of us no longer use both serial ports.

Alas, if you disable the PS/2 mouse in the BIOS, Windows will still try to reserve IRQ 12 for the mouse, effectively making it impossible to use IRQ 12 with Plug and Play. This may be fixed in Windows 98, which understands USB, but you might need a BIOS upgrade, too. Ick.

Anyway, USB can't happen too soon for me. My next system will be designed from the ground up for Windows 98, and I've begun collecting USB equipment. I have a keyboard, mouse, and joystick, and USB speakers are said to be on the way. I've seen a good monitor with USB outlets on both the front and back to make it easy to add new USB devices as they come along.

I asked quite a few mavens at WinHEC if they thought we would experience "USB driver hell" in Windows 98, with all these devices chained together. Alas, no one (including the tame Microsoft experts on such things) had enough data points to say. I suspect we're in for interesting times.

THE BOOK OF THE MONTH IS by Paul Johnson, *A History of the American People* (Harper Collins, ISBN 0060168366); a great sprawling story of the Americans from earliest times, written by a great and readable historian. I thought I knew the American saga, but this taught me things I didn't know. If you're not into a thousand pages on American history, let me shamelessly recommend *Starswarm* by Jerry Pournelle (Tor Books, ISBN 0312861834). Some think it the best thing I have ever done. Perhaps not, but I do find it good enough.

The computer book of the month is by Jeffrey McManus, *How to Program Visual Basic 5.0: Control Creation Edition* (Ziff-Davis Press, ISBN 1562764853). Massively illustrated, a good CD of source code, and a good technical level. It assumes you know something about Visual Basic and programming, and want to get started doing something practical. Don't choose this as your first book, but it wouldn't be a bad second one.

The game of the month is Blizzard Entertainment's Starcraft. (Think Warcraft in space.) It has some irritating features—I get very weary of the smart remarks from some of the troops—but the plot kept me interested, the play balance is about right, and I find I'm hooked despite myself. Starcraft is well behaved under both Windows 95 and NT, which is refreshing.

I know that last month I promised to tell how Roberta managed to get *http://www.readingtlc.com* up and running as a commercial Web site, complete with encryption for credit-card order security, installation of PGP, the exact correct version of Eudora, site construction, and publishing. Alas, it's a long story, and I haven't room this month. The moral of the story is that persistence pays: it took her weeks and a number of consultations with the Earthlink technical-support staff. Eventually she got far enough that one of Earthlink's people was able to walk her through the rest.

She was largely on her own, my role being moral rather than technical support, since it was an experiment. The story's good enough to be given in some detail.

Next month: BackOffice Small Business Server, trip reports, and I hope to clear up some of the backlog of good stuff that's forming a mound next to my desk. B

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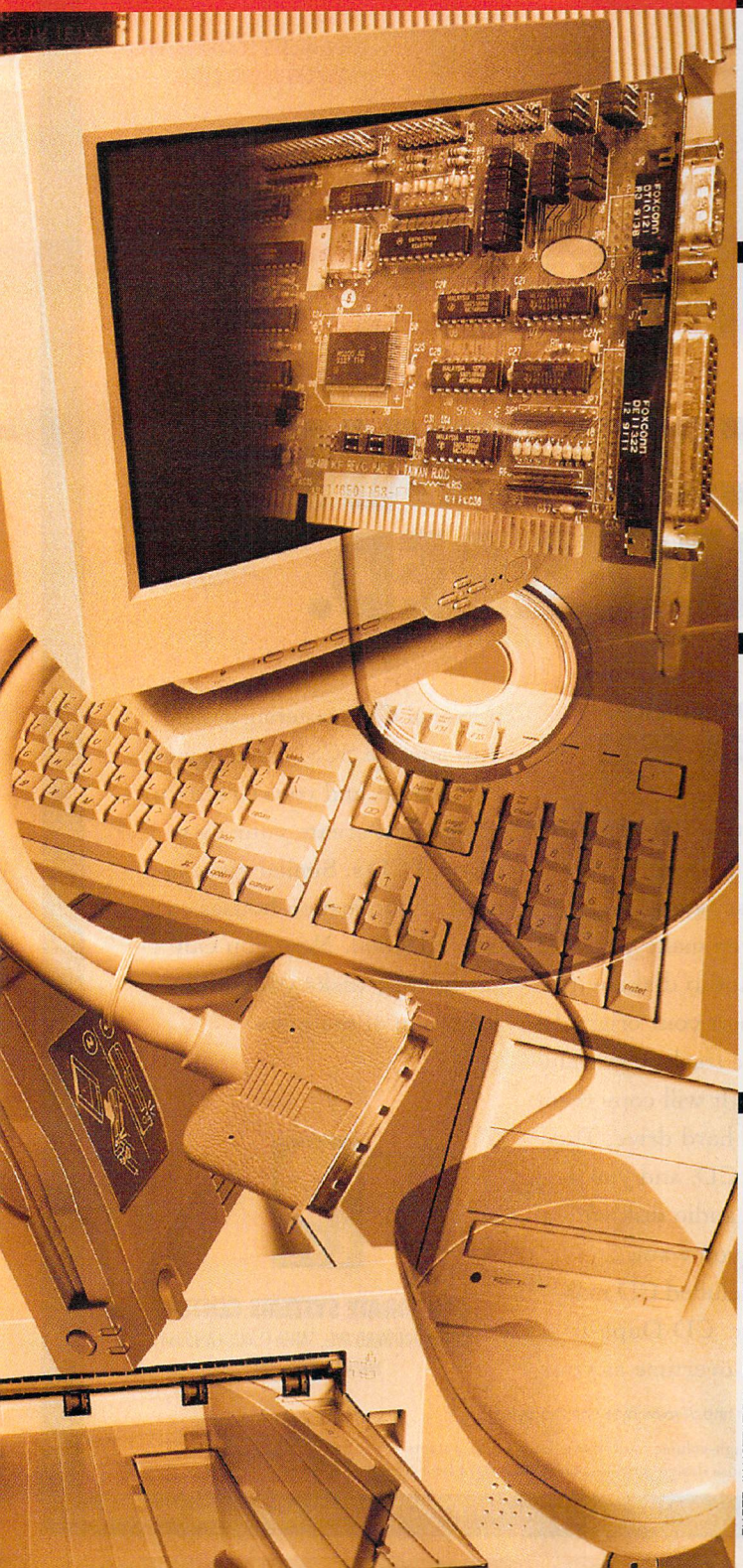


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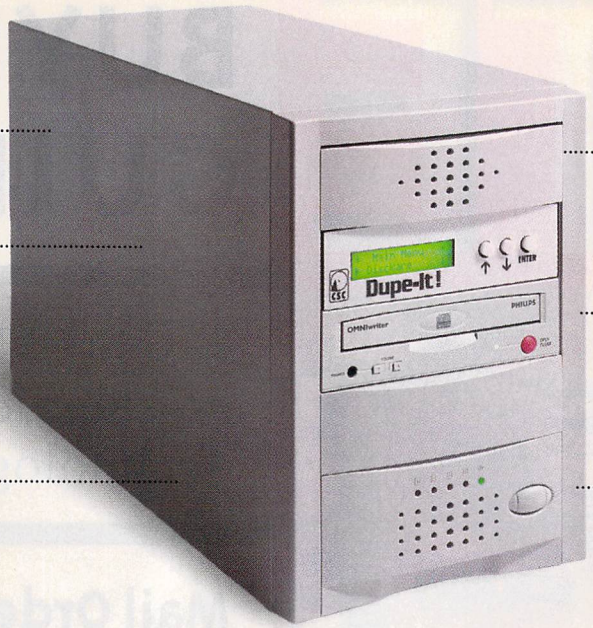
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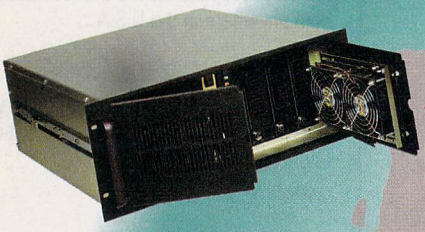
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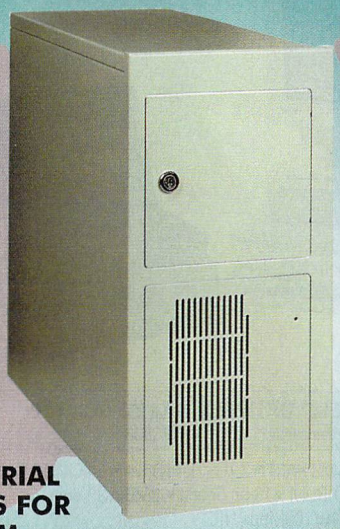
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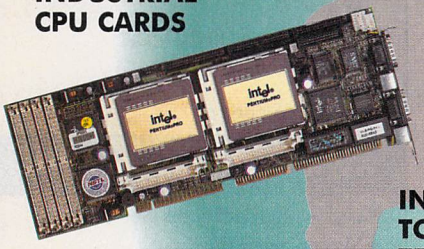


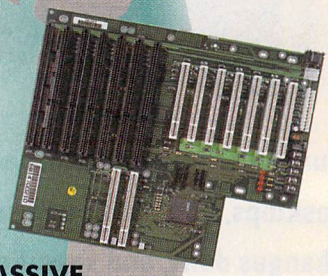
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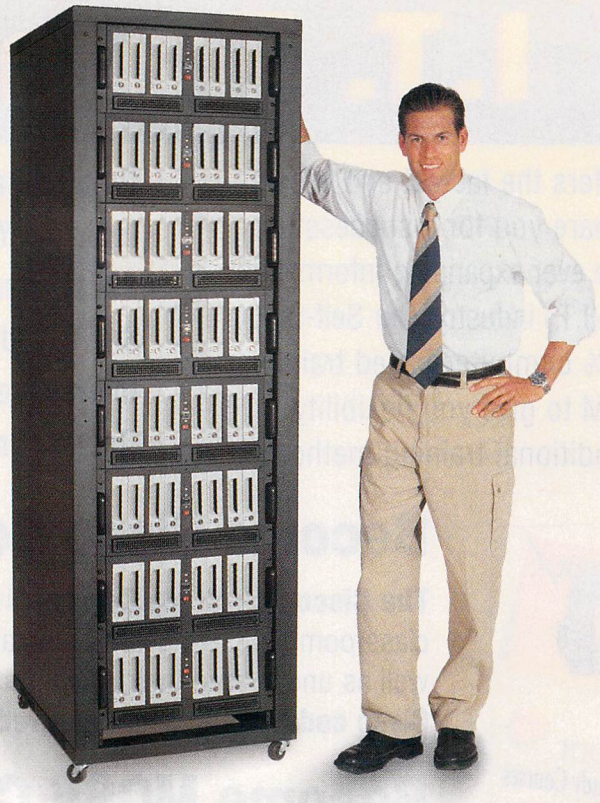
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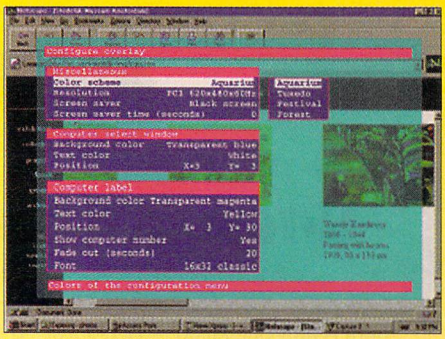
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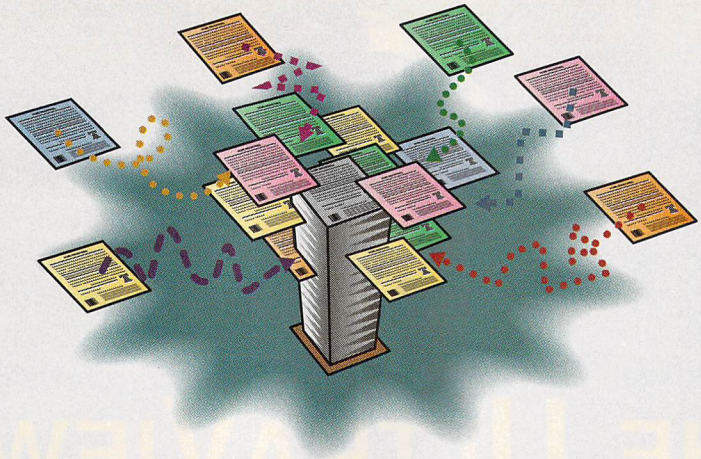
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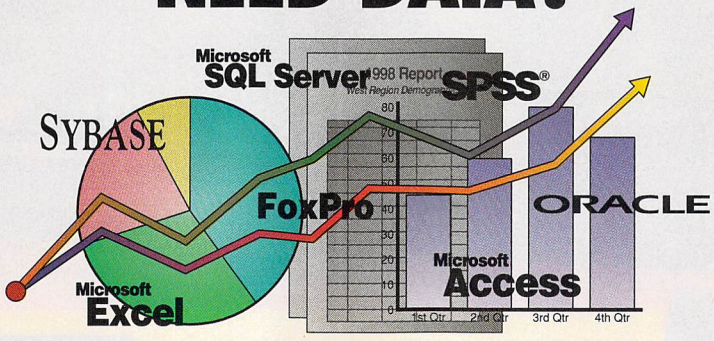
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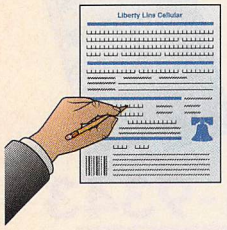



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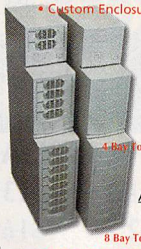


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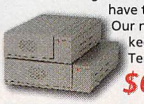
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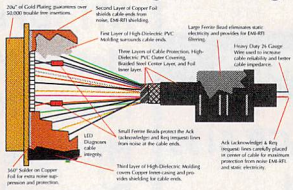
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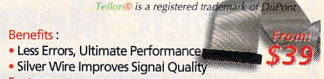


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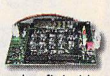



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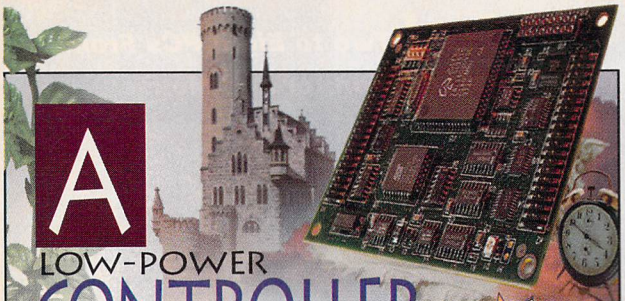
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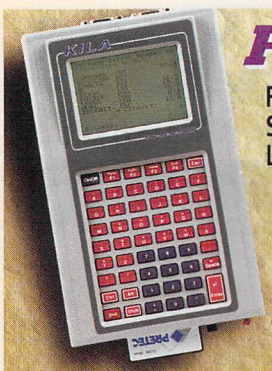
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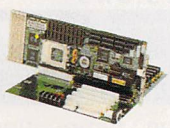
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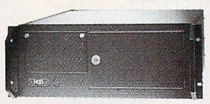
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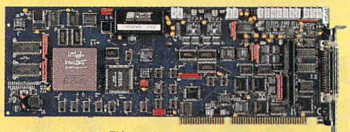





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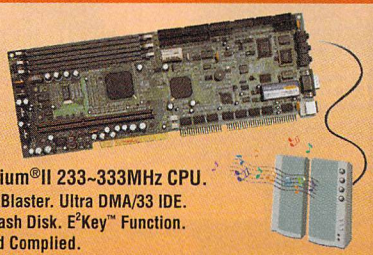
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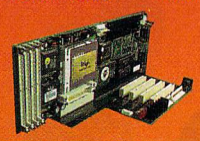
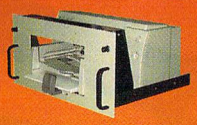




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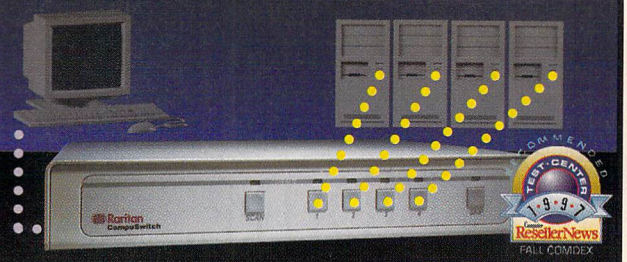
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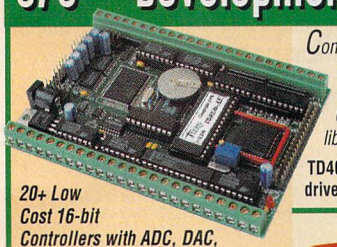


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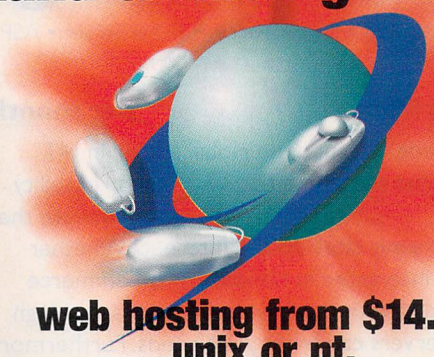
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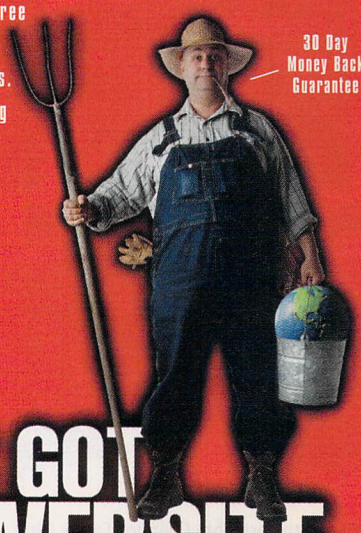
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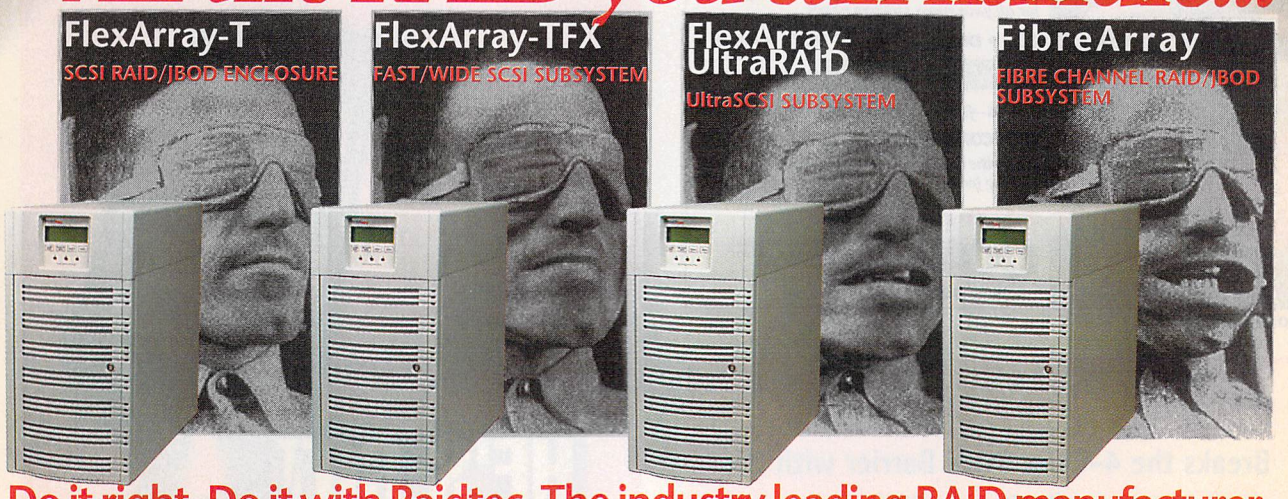
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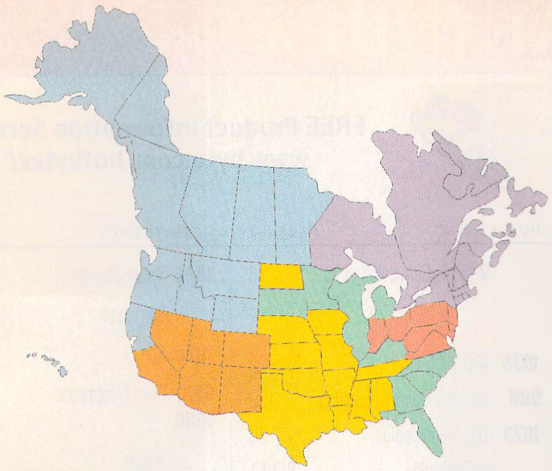
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# INTERNATIONAL ADVERTISING SALES STAFF

**Lori Silverstein,** *International Sales Director, 921 Eastwind Drive, Suite 118, Westerville, OH 43081 U.S.A.*
*Tel: +614-899-4908, Fax: +614-899-4999, lorisf@mcgraw-hill.com*

## BYTE ASIA-PACIFIC AUSTRALIA, HONG KONG, INDIA, INDONESIA, KOREA, MALAYSIA, PAKISTAN, PHILIPPINES, OTHER ASIA AND PACIFIC COUNTRIES, SINGAPORE, TAIWAN

**Weiyee In**
wei@byte.com

**Jennifer Chen**
jennchen@mcgraw-hill.com
#305 Nanking East Road,
Section 3, 10th floor
Taipei, Taiwan, R.O.C.
Tel: +886-22-715-2205
FAX: +886-22-715-2342

## KOREA

**Young-Seoh Chinn**
JES Media International
6th Fl., Donghye Bldg.
47-16, Myungil-Dong
Kangdong-Gu
Seoul 134-070, Korea
Tel: +82-2-4813411
FAX: +82-2-4813414

## GERMANY, SWITZERLAND, AUSTRIA

**Jürgen Heise**
jheise@mcgraw-hill.com
The McGraw-Hill Companies
Adam-Berg-Str. 115a
D-81735 Munich, Germany
Tel: +49 -89-680701-16
FAX: +49-89-680701-18

## ISRAEL

**Dan Aronovic**
rhodanny@actcom.co.il
DARA International
11 Hasheldag Street
P.O. Box 2335
Kadima 60920, Israel
Tel: +972-9-8995813
FAX: +972-9-8995815

## JAPAN

**Akiyoshi Kojima**
Japan Advertising Communications, Inc.
Three Star Building
3-10-3 Kanda Jimbocho
Chiyoda-ku, Tokyo 101 Japan
Tel: +81 3 3261 4591
FAX: +81 3 3261 6126

## ITALY, FRANCE, SPAIN, PORTUGAL, SCANDINAVIA

**Zena Coupé, Amanda Blaskett**
A-Z International Sales Ltd.
70 Chalk Farm Road
London NW1 8AN, England
Tel: +44 171 2843171
FAX: +44 171 2843174

**Emanuela Castagnetti**
emanuela.a-z@wanadoo.fr
A-Z International Sales Ltd.
BP18 Les Bossons
31 rue du Lyret
74400 Chamonix, France
Tel: +33 (0)4 50 531339
FAX: +33 (0)4 50 531368

## UNITED KINGDOM, BENELUX

**Darren Sharp**
Tel: +44 171 495 6780
The McGraw-Hill Companies
34 Dover St.
London W1X 4BR
England
FAX: +44 171 4956734

# EDITORIAL INDEX

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| HOTBYTES NO. | | PAGE NO. |
|---|---|---|
| | **A** | |
| **1022** | Acer | 32IS 20 |
| **1062** | Acer Peripherals | 90 |
| **1018** | ACS Innovation | 139 |
| **999** | Acucorp | 139 |
| **1063** | Akia | 90 |
| | Allaire | 8ONA1 |
| | AlphaBlox | 8ONA1 |
| | Arbor Software | 8ONA1 |
| **993** | Attachmate | 139 |
| | **B** | |
| **1049** | BackWeb Technologies | 98 |
| | BITSouce | 88K |
| **1045** | Blizzard Entertainment | 111 |
| | Brio Technology | 8ONA1 |
| | Business Objects | 8ONA1 |
| | **C** | |
| **996** | CenterLine Software | 139 |
| | Citrix | 20 |
| | Cognos | 8ONA1 |
| **1064, 1065** | Compaq | 90 |
| | Creative Labs | 32IS 13 |
| **987** | Cross Pen Computing | 139 |
| | CyberSource | 88K |
| | **D** | |
| | D2K | 8ONA1 |
| **986** | Data General | 139 |
| **1057** | Dell Computer | 110 |
| | Diamond Multimedia Systems | 32IS 13 |
| **978** | Digital Equipment Corp | 139 |
| **1003** | Dynamic Pictures | 139 |
| | **E** | |
| | ECMA | 47 |
| **1066** | Eizo Nanao Technologies | 90 |
| | Ensonig Corp. | 32IS 13 |
| | ESS Technology | 32IS 13 |
| | **H** | |
| **1023** | Hewlett-Packard | 32IS 20, 20 |
| **981** | HP | 139 |
| | **I** | |
| | IBM | 8ONA1, 139 |
| | IEEE | 39 |
| **1069** | iiyama NA | 90 |
| | Information Advantage | 8ONA1 |
| | Information Builders | 8ONA1 |
| | Information Transport Associates | 32IS 7 |
| | Informix Software | 8ONA1 |
| | InfoSpace | 8ONA1 |
| **1035** | Infoware | 32IS 20 |
| | Inprise | 85 |
| | Intel | 65 |
| | Intellinet | 32IS 7 |
| | Internet Security Systems | 88C |
| | Intrusion Detection | 88C |
| **1047** | Iomega | 111 |
| **982** | Ioptics | 139 |
| | IQ Software | 8ONA1 |
| | **J** | |
| **1044** | JE Software | 111 |
| | **L** | |
| **1001** | Lakeside Software | 139 |
| | LANovation | 65 |
| **1060** | Lernout & Hauspie | 139 |
| **980** | LexMark | 139 |
| **1070** | LG Electronics | 90 |
| | Lotus | 20 |
| **989** | Lucent Technologies | 139 |
| | **M** | |
| **1050** | Marimba | 98 |
| **1039** | Maxon Computer | 32IS 20 |
| **991** | Metacreations | 139 |
| **983** | Micron | 139 |
| | Microsoft | 8ONA1,88C, 20, 65, 87 |
| **992** | MicroStrategy | 8ONA1, 139 |
| **1043** | Mijenix | 111 |
| **1071, 1072** | Mitsubishi | 90 |
| **1027** | Montal Group | 32IS 20 |
| | Motorola Semiconductors | 43 |
| | **N** | |
| **1038** | NAG | 32IS 20 |
| **998** | Narrative Communications | 139 |
| **1073** | NEC Technologies | 90 |
| | NetDynamics | 8ONA1 |
| **1052** | Netpresenter B.V. | 98 |
| | NetSales | 88K |
| **1017** | Network Computing Devices | 139 |
| | New Moon | 20 |
| **1074** | Nokia Display Products | 90 |
| | Nokia Telecommunications | 32IS 7 |
| | Novell | 20, 65 |
| | **O** | |
| | On Technology | 65 |
| | Oracle | 8ONA1, 49 |
| | OrderTrust | 88K |
| | **P** | |
| **979** | Panda Project | 139 |
| **1000** | Pinnacle Systems | 139 |
| **1019** | Pios Computer | 32IS 20 |
| | Platinum Technology | 65 |
| **988** | Play | 139 |
| | Portland Software | 88K |
| | Preview Software | 88K |
| **1075** | Princeton Graphic Systems | 90 |
| | **R** | |
| | Release Software | 88K |
| | RSA Data Security | 41 |
| | Sagent Technologies | 8ONA1 |
| | **S** | |
| **1076, 1077** | Samsung | 90 |
| | SAS Institute | 8ONA1 |
| **1078, 1079** | Sceptre | 90 |
| | SCO | 20 |
| | Seagate Technology | 8ONA1 |
| | Secure Networks | 88C |
| | Siemens | 87 |
| **1026** | Smart Storage | 32IS 20 |
| | Somarsoft | 88C |
| **1028** | Sony | 32IS 20 |
| **990, 1080** | Sony Electronics | 90, 139 |
| | Sqribe | 8ONA1 |
| **1055** | StarBurst Communications | 98 |
| **1024, 1025** | STB Systems | 32IS 20 |
| **977** | Sun | 139 |
| | Sybase | 8ONA1 |
| **1042** | Symantec | 111 |
| **1041** | Syncronys Softcorp | 111 |
| **1046** | SyQuest | 111 |
| | **T** | |
| | Tekcentric | 20 |
| **1020** | Tektronix | 32IS 20 |
| | Telelogos | 32IS 7 |
| | TestDrive | 88K |
| **1030** | Texas Instruments | 32IS 20 |
| **1054** | Tibco | 98 |
| **997** | TriNet Services | 139 |
| | Turtle Beach Systems | 32IS 13 |
| | **V** | |
| **984, 1081** | ViewSonic | 90, 139 |
| | VIT | 8ONA1 |
| | **W** | |
| **994, 1051** | Wall Data | 98, 139 |
| **1056** | Wayfarer Communications | 98 |
| **995** | Web 3000 | 139 |
| | **Y** | |
| **1029** | Yamaha-Kemble Music | 32IS 20 |
| | **Z** | |
| | Zanza | 8ONA1 |
| **1040** | Ziegler Informatics | 32IS 20 |


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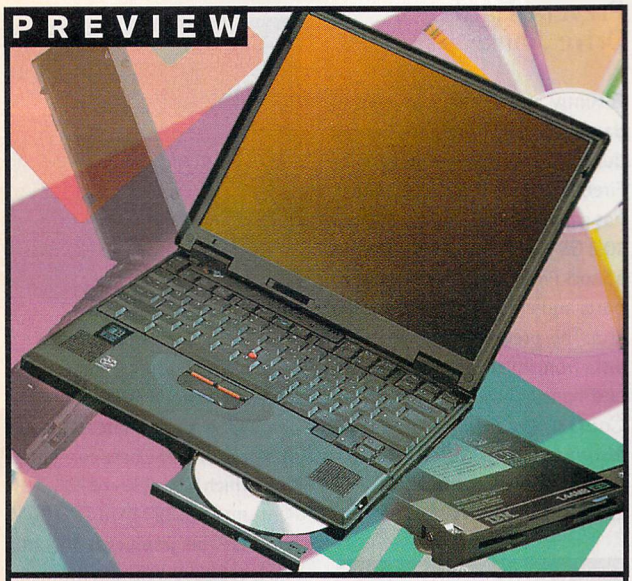
www.byte.com

# What's New

Hardware

*This month, check out some powerful workstations, new storage media, a simplified drawing tool, and translation software.*

PREVIEW



**ThinkPad 600**
**$4599**

**Enter HotBYTEs No. 1008.**

**IBM Corp.**
White Plains, NY
800-426-7255 ext. 4751
http://www.ibm.com/pc/us/thinkpad

## Power and Portability Combined

IBM's ThinkPad 600 combines the power of the ThinkPad 760 and the lightweight portability of the 560 in one machine.

The 600's case is 1.4 inches thick, barely thicker than the 560's. It weighs in at 4.99 pounds with an empty bay (5.55 pounds with a full bay) and measures 11.8 inches long by 9.4 inches wide. At a cost of $4599, the 600 comes with a 266-MHz Mobile Pentium II, a 4-GB hard drive, 32 MB of RAM, 2 MB of graphics memory, one Type III or two Type II CardBus slots, an internal 56K fax/modem, and a 13.3-inch thin-film transistor (TFT) screen.

The floppy drive can either be used with an external connection or be swapped with the 24X CD-ROM drive. One nice new enhancement on the 600 is the TrackPoint pointer, which lets you press the pointing device itself to click on the screen. The device also includes a button for fast scrolling.

The microphone and headphone ports are easily accessible, but we found that the sound card didn't work with a number of voice-recognition products, including IBM's own ViaVoice. The system's lightweight plastic case is sturdy enough, although several of the plastic door flaps are easy to break off. The battery, which lasted for 3¼ hours of continuous use, has been redesigned so that it pops out of the unit. This is an improvement over its slide-out predecessor, which tended to let in dust. Overall, the ThinkPad 600 is a nice blend of power and portability. **–Chrystie Kilbourne-Terry**

PHOTOGRAPH: STEVEN GREENBERG © 1998

## Systems

### Frankenstein's Workstation

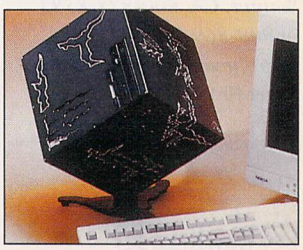
TOO BIG TO FIT ON A DESK, THE SUN ULTRA 450 is about the size of a filing cabinet, sits on wheels, and packs up to four 300-MHz Ultra II CPUs with 2 MB of cache, 10 PCI slots, and two Elite 3-D graphics boards with six floating-point processors. This monster system, which is based on the Sun 450 workgroup server, can hold 20 9-GB disk drives, four of which are hot-pluggable. It also has SCSI connections on the back for RAID, 10Base-T Ethernet integrated on the motherboard, and a 100-MHz Ultra Port Crossbar system bus. Sun says the system will be available in limited quantities for medical imaging, geo science, and high-end CAD applications. Pricing will be similar to that of the Sun 450 server ($14,650).
*Contact: Sun Microsystems Computer Corp., Palo Alto, CA, 650-960-1300; http://www.sun.com.*
**Enter HotBYTEs No. 977.**

### More Power for Publishing

QUARK, COREL, IN:SYNC, AND METACREations have ported imaging and layout applications to the Alpha platform, which means digital-content creators can now take advantage of the powerful 500-MHz Alpha CPU. And, with FX32 emulation software, users can run most non-native applications on Alpha. The Digital Creation Studio ($6995) comes loaded with the PowerStorm 4D51T graphics subsystem, 128 MB of ECC SDRAM, up to an 18-GB hard drive, a 21-inch monitor, and a 333-MHz Pentium II or 500-MHz Alpha processor. The unit comes with CorelDraw 8, Painter 5.0, Bitstream Font Navigator, and Dragon's NaturallySpeaking software.
*Contact: Digital Equipment Corp., Littleton, MA, 800-722-9332 or 978-493-5111; http://www.workstation.digital.com.*
**Enter HotBYTEs No. 978.**

### The Funkified Desktop

ROCK CITY IS MORE THAN A FUNKY-LOOKing machine; it's a fairly powerful system with prices starting at $895.



The box balances on one point, offering a diminished desktop footprint, and comes with internals such as a 200-MHz MMX Pentium with AGP and a 100-MHz bus.
*Contact: The Panda Project, Inc., Boca Raton, FL, 561-994-2300; rockcitysales@pandaproject.com; http://www.rockcity.net.*
**Enter HotBYTEs No. 979.**

### Windows CE Terminals

THE NCD THINSTAR ($699) IS ONE OF THE first thin-client computers to deploy Microsoft's Windows CE lightweight OS. Network Computing Devices claims that putting Windows CE on the machine makes it easy to adopt emerging technologies. The system supports Microsoft's Remote Desktop Protocol and Citrix's Independent Computing Protocol and offers access to multiuser Windows NT.

*Contact: Network Computing Devices, Mountain View, CA, 650-694-0650; http://www.ncd.com.*
**Enter HotBYTEs No. 1017.**

## Monitors

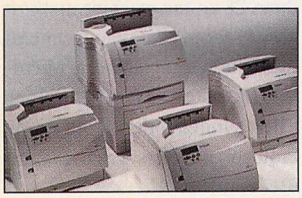
### Better Pictures in Smaller Spaces

ViewSonic's PS790 19-inch monitor (with an 18-inch viewable area) now has a smaller footprint, thanks to a reduced depth that's about 3 inches less than that of a standard 19-inch monitor. It delivers a maximum resolution of 1600 by 1280 pixels, a 0.25 true dot pitch, and a refresh rate of 88 Hz. The monitor, which costs $899, is geared toward graphics, presentation, and CAD/CAM applications.
*Contact: ViewSonic Corp., Walnut, CA, 800-888-8583 or 909-869-7976; http://www.viewsonic.com.*
**Enter HotBYTEs No. 984.**

## Printers

### Lexmark Laser Printers Get Faster

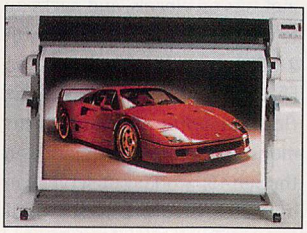
Lexmark's 1200-dpi monochrome laser printers feature NEC's latest Vr-series Mips RISC processor for better throughput. Lexmark claims the Optra S 1855's time-to-first-page print rating is 10 seconds. Four units are available, with different speeds: 12 ppm (the $950 Optra S 1255), 16 ppm (the $999 Optra S 1625), 18 ppm (the $1129 Optra S 1855), and 24 ppm (the $1999 Optra S 2455). The Optra S series offers numerous options, including a duplexer, an 85-envelope feeder, drawers with an up-to-2000-sheet capacity, 10Base-T/100Base-TX Ethernet adapters, and more. All



the printers include a printer-management utility.
*Contact: Lexmark International, Inc., Lexington, KY, 800-539-6275 or 606-232-2000; http://www.lexmark.com.*
**Enter HotBYTEs No. 980.**

### Print Bigger with Less Trouble

The HP DesignJet 3000CP ($13,995) and 3500CP ($16,995) aim to alleviate the demands that printing large, wide-format images puts on your systems. The 3500CP has up



to 68 MB of RAM and a 4.3-GB hard drive, while the 3000CP includes 68 MB of RAM. All this storage is designed to eliminate the need for host processing of PostScript files, freeing up your system resources. Both units print on media measuring up to 54 inches wide.
*Contact: Hewlett-Packard Co., Palo Alto, CA, 800-527-3753 or 650-857-1501; http://www.hp.com.*
**Enter HotBYTEs No. 981.**

## Videoconferencing

### Give Your Videoconference Pizzazz

The SpaceCam VideoPhone ($139) adds multimedia and broadcast effects to videoconferencing. This parallel-port camera captures and transmits up to 30 frames per second; supports dual windows, text, graphics, and transition effects; and works via Internet or direct-modem connections. SpaceCam includes a HyperGate window that lets you drop in graphics, sound, pictures, or documents to send through the SpaceCam connection. It also offers interpolation to reduce blockiness and image artifacts.
*Contact: Play, Inc., Rancho Cordova, CA, 916-851-0800; http://www.play.com.*
**Enter HotBYTEs No. 988.**

## Hard Drives

### Prevent Hard Drive Abuse

Quantum believes that a majority of damaged hard drives are injured during installation or shipment. Its Fireball EL ($169 to $359), which has capacities of 2.5, 5.1, 7.6, and 10.2 GB with a 512-KB buffer, has a Shock Protection System that supports and cradles the hard drive's arm. This prevents damage to the disks from impact should the drive be dropped, abused, or mishandled.
*Contact: Quantum Corp., Milpitas, CA, 408-894-4000; http://www.quantum.com.*
**Enter HotBYTEs No. 985.**

## Input Devices

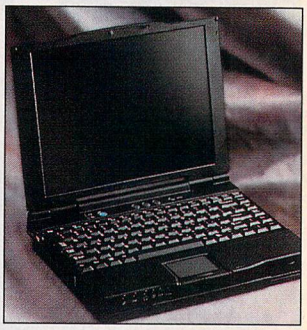
### Write Right into Your PC

To input handwritten notes into your computer, simply place an 8½- by 11-inch pad of paper on top of the CrossPad tablet and write with the special pen. The unit can save cursive text, lettering, and doodles, which you can upload by simply plugging the CrossPad into any COM port on your computer. Files are uploaded into the IBM Ink Manager software, which comes bundled with the CrossPad. Text can be saved in the Ink Manager as ASCII for exporting into word processors. Doodles and drawings are saved in a proprietary format that can be imported into Microsoft Office applications. To familiarize the CrossPad with your handwriting, you simply write 100 words from a script. The unit costs $399.
*Contact: Cross Pen Computing Group, Linclon, RI, 401-333-1200; http://www.cross-pcg.com.*
**Enter HotBYTEs No. 987.**

## Notebooks

### A Lighter Heavyweight Laptop

The Micron GoBook is a 1.3-inch-thick, 4½-pound notebook that, when you add an optional battery



pack and media bay, leads a double life as a high-end multimedia machine with an estimated 11 hours of battery life. The base configuration, which has a 233- or 266-MHz Pentium CPU, 32 MB of EDO RAM, and a 128-bit graphics accelerator, starts at $2599. Without the media bay, which gives the system port replicators and networking capabilities, the unit has an estimated battery life of 3 hours.
*Contact: Micron Electronics, Inc., Nampa, ID, 800-249-1179 or 208-898-3434; http://www.micronpc.com.*
**Enter HotBYTEs No. 983.**

## Servers

### Modular Multiuser Servers

The TermServer-in-a-Box from Data General grows with your thin-client architecture. The 73-inch-tall system (pricing varies by configuration) can hold as many as seven Data General AViiON 2650R rack-mounted servers ($6700 apiece), each of which deploys single or dual Pentium II processors and can support up to 50 users, the company claims. TermServer-in-a-Box supports Windows NT, Terminal Server Edition, and Citrix's WinFrame.
*Contact: Data General, Westborough, MA, 800-328-*

*2436 or 508-898-5000; http://www.dg.com.*
**Enter HotBYTEs No. 986.**

## Internet Telephones

### Reach Out and Touch a PC

ONCE THE FREESPEECH ($99) CARD IS INstalled and your phone is connected to a PC, you can talk to someone over the Internet using a standard phone instead of talking through a PC's microphone and headset. ACS Innovation claims the audio quality is high, thanks to on-board DSP, which performs compression and AEC. The Pro version ($149) facilitates calls from local dynamic IP users to destination dynamic IP users (as well as fixed IP users). Following a 2-second PSTN call from the local party to the destination party, either party can opt to transfer a call to the Internet. An Internet connection that's transparent to both parties is then established, application software is launched, and the parties are matched via a directory server. One party can "wake up" a remote PC to establish a connection. A version for two lines sells for $199.
*Contact: ACS Innovation, Inc., Santa Clara, CA, 408-566-0900; http://www.acscompro.com.*
**Enter HotBYTEs No. 1018.**

## Networking

### Get a Handle on Emerging Standards

TO ALLEVIATE ANY TIE-UPS THE MULTIPLICity of protocols in use today can cause for ISPs, public carriers, and network administrators, Lucent's PortMaster4 provides multiservice access concentration. Thus, when a switched call comes through a single phone number, the system determines the type of call—ISDN, ISDN data-over-voice, K56flex, or V.90 modem—and switches service on the port to appropriately handle it. On a single chassis, the PortMaster 4 supports up to 864 simultaneous ISDN or 56K connections, according to Lucent. Current systems can handle emerging xDSL and voice-over-IP standards. The cost is $519 per port.
*Contact: Lucent Technologies, Murray Hill, NJ, 888-582-3688; http://www.lucent.com.*
**Enter HotBYTEs No. 989.**

## Storage

### New ROM Media

IOPTICS' OROM IS A ROM OPTICAL-STORage technology with a 128-MB storage capacity in a removable data card. A hand-held reader for accessing data costs $200, and the cards are priced at under $3. Ioptics hopes to see OROM used to deploy data and applications to Windows CE and embedded devices.



*Contact: Ioptics, Inc., Bellevue, WA, 425-468-2400; http://www.ioptics.com.*
**Enter HotBYTEs No. 982.**

## DVD

### Everything You Need for DVD

SONY'S DDU220E/H DVD-ROM BUNdle ($349) reads CD-ROM, CD-Recordable, and CD-Rewritable discs at a maximum speed of 32X. The DVD-ROM bundle includes the Realmagic DVD Hollywood III PCI MPEG-2 decoder card from Sigma Designs, driver software, an audio cable, and two DVD-ROM titles. The bundled Realmagic DVD Hollywood III card allows the DVD-ROM output to bypass the computer's video card for high-quality DVD output directly to a computer monitor.
*Contact: Sony Electronics, Park Ridge, NJ, 800-352-7669; http://www.sony.com/.*
**Enter HotBYTEs No. 990.**

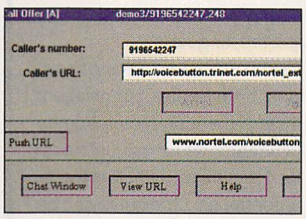
## SOFTWARE
## The Web

### Universal Web Application Server

WITH WALL DATA'S CYBERPRISE SERVER 2.0 ($25,000), you can deliver content to employees, partners, and customers through a Web browser. For use with NT, Cyberprise lets you manage user access, encryption, and channel delivery of content, so the appropriate people can access the right data, whether they're internal or external to your organization. You can remotely administer your Cyberprise applications using a Web browser. With Cyberprise Host ($200 per concurrent user), which requires Cyberprise Server 2.0, you can extend access to a variety of mainframe, AS/4400, and Unix-based computers.
*Contact: Wall Data, Inc., Kirkland, WA, 800-915-9255 or 425-814-9255; http://www.cyberprise.com.*
**Enter HotBYTEs No. 994.**

### Phone Service on the Web

TRINET, THE INTERNET PROFESSIONAL SERvices Division of Interpath Communications, offers a Voice Button Service that lets businesses help potential customers initiate a voice connection over standard




phone lines with the click of a button on a Web site. Voice Button (from $250 per month) passes information from a Web-site user to a Web-site owner via software that resides on the ISP's server. Customer-service representatives can then push Web pages directly to on-line users' screens. Customers have the choice of using either a second phone line or any commonly available voice-over-IP application that carries phone calls over the Internet.
*Contact: TriNet Services, Cary, NC, 919-654-2247; info@trinet.com; http://www.trinet.com.*
**Enter HotBYTEs No. 997.**

### The Future of Mass Marketing

THE ENLIVEN/CAPTURE SYSTEM ($4 PER lead generated) lets Webmasters take advantage of the direct-marketing capabilities of the Web and permits advertisers to solicit and capture detailed information from end users from advertising banners on the Web. Potential customers can obtain information or make purchases through a banner without having to go to other Web sites, and the system supports encrypted point-of-sale programs within the banner.




*Contact: Narrative Communications Corp., Waltham, MA, 781-290-5300; info@narrative.com; http://www.narrative.com.*
**Enter HotBYTEs No. 998.**

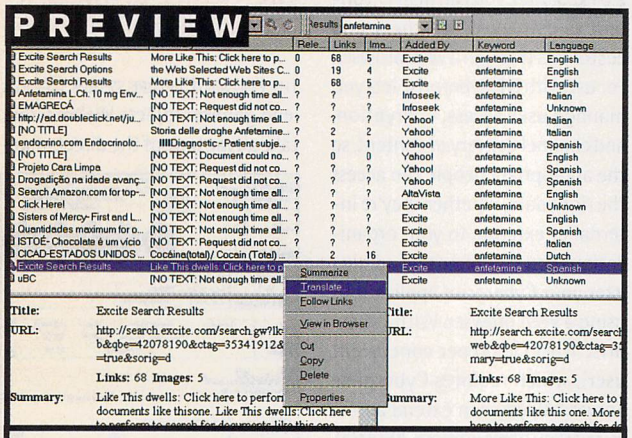
### Easier Host-to-Web Access

WITH HOSTVIEW SERVER 2.0 ($1995 PER NT server), Attachmate delivers advanced security and management features plus a server-based approach to its host access program. Version 2.0 of the program includes the Aventail VPN security engine, which provides authentication, encryption, and a secure firewall for people accessing mainframe data via the Internet or an intranet. The program also has an access-control and management console that you

can control from a Web browser. Access-control/management capabilities are also included in the Extra Personal Client.
*Contact: Attachmate Corp., Bellevue, WA, 800-426-6283 or 425-957-7764; support@attachmate.com; http://www.attachmate.com.*
**Enter HotBYTEs No. 993.**

## More-Economical Web Caching

THE NETSONIC INTERNET ACCELERATOR IS a Windows 95 utility that speeds Web surfing by caching Web pages on your hard disk and keeping track of any changes made to a page since you last visited. Not a proxy, it replaces your browser's cache with its own and checks for new content and notifies you via a sound or pop-up notice if new content is detected. It checks only those graphics that are likely to change, and it guarantees that what you're looking at is the most recent content. Web 3000 claims this can reduce Internet traffic by up to 80 percent. NetSonic is available now for free from Web 3000's Web site; a Deluxe version, to be available later this year, will have acceleration modes and prefetch settings.
*Contact: Web 3000, Inc., Redmond, WA, 425-836-3000; http://www.web3000.com.*
**Enter HotBYTEs No. 995.**




**Coronado**
**Price unavailable at press time**

**Enter HotBYTEs No. 1060.**

**Lernout & Hauspie**
Burlington, MA
888-537-6688
781-203-5336
fax: 781-238-0986
sales@lhs.com
http://www.lhs.com

## Coronado Unscrabbles the Web's Tower of Babel

With Lernout & Hauspie's Coronado, you can use the Web as a multilingual knowledge base, albeit with some translations made in broken English. The service, which was expected to become available in June, offers multilingual Internet search, summarization, and on-line machine translation. Coronado lets you enter a term in any of its supported languages. The query is translated and sent to Internet search resources in all supported languages.

Based on a client/server model, Coronado uses machine translation at its core. The service provides three levels of translation: automatic, manual/automatic, and manual (i.e., completely human translation). L&H promises a 24-hour turnaround for manual translations. The server does the automatic translation, manages translation jobs, and maintains customer information. One query can be sent to as many as 35 Internet search engines.

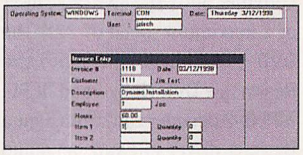
We tested a Coronado beta using English and Spanish. We made a query for a medical term in Spanish and received a plethora of document hits in several languages. We found the accuracy of the translations to be quite high, although the service is not perfect: It declared that some Web pages were written in Spanish when they were in Portuguese. For more accurate translation, you'll need to use Coronado's manual translation service.

Coronado translates from German, Spanish, and French into English and vice versa. Other languages under development include Japanese, Mandarin Chinese, Arabic, and Korean to and from English, and French to and from German. **–Elena Arroyo**

## Programming

## Deploy COBOL on the Web

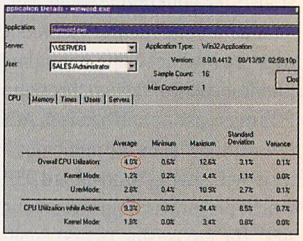
ACUCORP HAS RELEASED THE ACUCOBOL-GT 4.0 Development Suite (from $3050), which includes AcuCOBOL-GT, a 32-bit Web browser plug-in that gives COBOL application users access to applications and data over the Internet or an intranet via popular Web browsers. The application is designed to allow COBOL programmers to develop applications entirely within the COBOL syntax that can be used on the Internet/intranet. Using AcuCOBOL-GT, a COBOL programmer can embed applications on Web pages, either via a hyperlink or by using HTML. The suite runs on Windows 95 and Windows NT client machines inside a bundled Web browser.
*Contact: Acucorp, Inc., San Diego, CA, 800-262-6585 or 619-689-4500; http://www.acucorp.com.*
**Enter HotBYTEs No. 999.**



## Management

## Master Multiuser Windows

LAKESIDE SOFTWARE'S SYSTRACK ($1495 per server) is designed to help you handle the myriad administration problems associated with operating Windows NT Terminal Server, Citrix's Winframe, and Windows NT multiclient architectures. The package tracks the applications in use, system resources, and users, and it alerts administrators about any impending problems. SysTrack creates diagnostic reports for an ODBC database, showing resources used, the duration and cost of sessions (making it possible to bill users), and applications executed. It also alerts help-desk personnel to problems so they are prepared to deal with calls from disgruntled users.
*Contact: Lakeside Software, Inc., Waterford, MI, 800-969-7717 or 248-738-1138; sales@LakesideSoftware.com; http://www.LakesideSoftware.com.*
**Enter HotBYTEs No. 1001.**



## Development

## Ship Applications on Time

CENTERLINE'S NEW APPLICATION DELIVERY-management system, called Acqua, helps you determine a software project's current status and important tasks that need to be completed. Acqua's ($2000 to $4000 per participant) distibuted data collectors, which are available for tools such as Microsoft Project, Word, Intersolv PVCS/Tracker, Mercury WinRunner, nuMega BoundsChecker, several CenterLine tools, and oth-

er products, gather data that's already generated by the tools as developers use them. The data is collected and sent to the Acqua Application Server, which analyzes it to generate probabilities for meeting deadlines, alerts, and so forth. Participants can view the latest status of a project through their Web browsers.
*Contact: CenterLine Software, Cambridge, MA, 617-498-3000; info@centerline.com; http://www.centerline.com.*
**Enter HotBYTEs No. 996.**

## Software Update

**GroupWise 5.5** improves its capabilities as both a universal inbox for all your desktop communications and a collaborations tool, with upgraded Internet addressing, calendaring, and document-management features. Using Novell's NDS architecture, GroupWise keeps tabs on other GroupWise users, intelligently routing messages so that users don't have to manually update their address databases. Version 5.5 expands the calendar options for coordinating meetings; indexes all e-mail, documents, tasks, and scheduling on a system for quick searches; and offers access to all documents stored on the network. Pricing has not been set, but it's expected to be close to that of version 5.2, which costs $718 for five users.
*Contact: Novell, Inc., Provo, UT, 800-453-1267 or 801-861-7000; http://www.novell.com.*
**Enter HotBYTEs No. 1004.**

The **Wise Installation System 6.0** ($299), a distribution and deployment tool for Windows applications, includes a number of new features for easier installation of 16- and 32-bit applications. It can read Multi-String registry changes, supports more scripting-language code settings, and has improved speed for uninstall procedures. New functions in the Enterprise Edition ($699) include an integrated single-step debugger, the ability to create CD-ROMs, and support for frequently used scripting-command lists.
*Contact: Wise Solutions, Inc., Canton, MI, 734-981-4970; info@wisesolutions.com; http://www.wisesolutions.com.*
**Enter HotBYTEs No. 1005.**

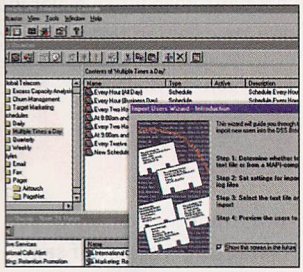
Citrix, whose software helped pioneer Windows-based terminals, has moved its **ICA Embedded Client** to the Windows CE OS. Moving this standard to Windows CE will let wireless hand-held devices connect to application servers, as well as provide Windows-based terminals with a lightweight OS. Citrix plans to deliver ICA (price unavailable at press time) on five Windows CE platforms—Mips, SH3, x86-compatible, ARM, and PowerPC processors.
*Contact: Citrix Systems, Inc., Fort Lauderdale, FL, 954-267-3000; http://www.citrix.com.*
**Enter HotBYTEs No. 1006.**

**Norton Mobile Essentials** ($79.95) is, as the name implies, a suite of utilities for your mobile computer. Like Symantec's Norton Utilities for the desktop PC, it checks for viruses, automatically saves and recovers files, and performs system diagnostics. Of course, it has a host of functions just for mobile computing, and it adjusts settings so that you can log on in foreign countries. The software also works to resolve connection problems, defends the system against trauma associated with rough handling, and keeps track of your travel information.
*Contact: Symantec Corp., Cupertino, CA, 800-441-7234 or 541-334-6054; http://www.symantec.com.*
**Enter HotBYTEs No. 1007.**

## Analysis

### It's Your Database Calling...

MICROSTRATEGY'S DSS BROADCASTER send users text or numeric messages, alarms, or warnings from a corporate database via pager, e-mail, fax, or mobile phone. When a user-defined event happens, such as a sharp decline in inventory, a message is sent to the appropriate



persons through the medium of their choice. DSS Broadcaster runs on Windows NT; pricing starts at $50,000.
*Contact: MicroStrategy, Vienna, VA, 703-848-8600; http://www.strategy.com/.*
**Enter HotBYTEs No. 992.**

## Video Editing

### Editing for Everyday Use

PINNACLE SYSTEMS' STUDIO 400 IS A video-editing application with a graphical interface and a time-line storyboard view for each scene. You can superimpose titles or graphics over the video scenes and automatically generate a soundtrack to match the video. The program ($199) has a voice-over recorder for creating a synchronized narration while you watch the clips. The Studio 400 system also has a SmartCapture feature that outputs full-resolution videotapes and requires only 150 MB for 1 hour of recorded film. The system outputs digital movies for video e-mail, Internet, or multimedia use. The tutorial and on-line help include a video-editing tutorial.
*Contact: Pinnacle Systems, Inc., Mountain View, CA, 650-526-1600; http://www.pinnaclesys.com.*
**Enter HotBYTEs No. 1000.**

## Graphics

### More Power for 3-D Graphics

TOGETHER WITH THE OXYGEN 3D GRAPHICS accelerators, Dynamic Pictures' PowerThreads Oxygen 3.0 drivers are geared to harness the power of a multiprocessor PC. Even if you run a program written to address only one CPU, PowerThreads' multithreaded technology distributes processing requirements across multiple Intel CPUs. The Oxygen drivers cost $99 each.
*Contact: Dynamic Pictures, Inc., Santa Clara, CA, 408-327-9000; http://www.dynamicpictures.com.*
**Enter HotBYTEs No. 1003.**

## Illustration

### A Blast from the Past

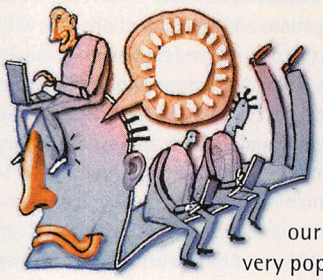
POPULAR OLD APPLICATIONS ARE OFTEN THE victims of bloat; more and more features are added over the years until the application becomes unfamiliar to longtime users. MetaCreations has taken the unusual step of defeaturing its Painter drawing tool, keeping what it considers essential features from all previous versions, and released a new version, called Painter Classic, for $99. The new application is designed to make it easy to get down to the business of drawing on your PC. It offers a shorter learning curve for new users and presents a familiar interface for longtime users who prefer the original, simpler release of Painter.
*Contact: MetaCreations Corp., Scotts Valley, CA, 408-430-4000; http://www.metacreations.com.*
**Enter HotBYTEs No. 991.**

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## Advances and Retreats in Computing

# HIGH TOLERANCE Specs



Nowadays, most organizations encourage their people to learn about tolerance. The providing of classes, seminars, and workshops on tolerance has blossomed into a major industry. We are entering this lucrative field.

Three months ago, we began marketing a series of seminars/workshops about tolerance. Designed specifically for the high-tech environment, our morning sessions teach "How to Tolerate Intolerable Coworkers." Afternoons are for "How to Tolerate Intolerable Managers." Weekend sessions, for managers only, cover "How to Tolerate Intolerable Employees."

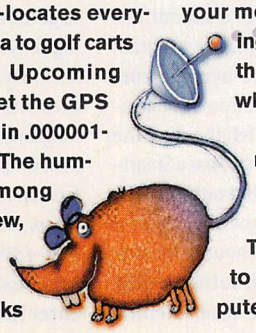
Our prices are unreasonable, and this makes our seminars and workshops very popular with the executives who hire us. We are straining to keep up with the demand.

In the next few months, we will introduce these seminars for marketing professionals: "Teaching Customers How to Tolerate Intolerable Pricing" and "Teaching Customers How to Tolerate Intolerable Quality." Down the line, we will also offer books, films, and multimedia versions—as many of them as the market will tolerate.

# Virtual Mouse Pads

**The computer mouse, useful and ubiquitous though it is, has well-documented problems, which we need not rehash here. A better mouse is upon us. The LocoMouse™, produced by the LocoMouse Company, is by far the most accurate, least cumbersome computer mouse on earth. It has no external wires to connect it to the computer, and it doesn't need a rollerball or infrared sensor to ascertain its position vis-à-vis the tracking surface. Indeed, it needs no tracking surface at all. Behold the advent of the virtual mouse pad.**

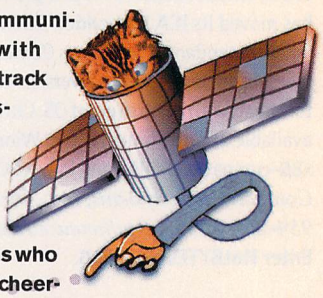
**The LocoMouse is a technological blend of the mouse and the Global Positioning System. The satellite-based GPS now geo-locates everything from ships at sea to golf carts on the back nine. Upcoming improvements will let the GPS locate objects to within .000001-centimeter accuracy. The humble mouse will be among the first to use the new, literally pinpoint, precision technology.**



**The LocoMouse looks like a little lump of goo. You hold it in your hand and squeeze it into a comfortable shape. Inside the LocoMouse is a single-chip GPS transmitter. As you move the mouse, GPS satellites track its location.**

**The LocoMouse Company is a pioneer not just in technology but in customer service, too: You will never lose your mouse. If your mouse is missing, you can use your PC to query the GPS and instantly determine where your mouse is.**

**The company recognizes that many people never learned to use GUI keyboard equivalents instead of mouse clicks. Those users will need a mouse to communicate with their computer to instruct the computer to communicate with the GPS to track down the missing LocoMouse. So, the company has on-call 24/7 technicians who will swiftly and cheerfully come to your house or office and temporarily plug in a mechanical mouse.**



**If a technician fails to appear within 96 hours of your telephone call, the company guarantees that it will go out of business. The comfort you get from this policy is indescribable.**

*Marc Abrahams is the editor of the* Annals of Improbable Research. *You can e-mail him at marca@improb.com, or visit www.improb.com.*

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# VICTORY.



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The war is over and a new era is dawning – the era of the powerful *and* affordable notebook. The proof? The industry experts at *PC Magazine* have just designated our richly configured Dell® Inspiron™ 3200 D266XT the best value notebook with their Editors' Choice Award, noting, "The Inspiron proves you don't have to break the bank to buy the latest in notebook technology." In fact, they called it "an outstanding bargain" that "doesn't cut back on any key components." After all, it features Intel's fastest mobile Pentium® II processor, running at 266MHz, along with 80MB of SDRAM and a 24X Max CD-ROM for full multimedia capabilities. All for under $3000. Who says you have to take a hit when buying a cutting-edge notebook? Give us a call or visit our website. And order your share of the peace dividend today.

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- 32X Max^ Variable CD-ROM Drive
- Yamaha Wavetable Sound
- Altec Lansing ACS-90 Speakers

★ *Upgrade to 64MB SDRAM, add $79.*
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- 2X DVD-ROM Drive and Decoder Card
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- ACS-495 Full Dolby Surround Sound Speakers with Subwoofer
- Iomega Zip 100MB Internal Drive
- Dell QuietKey Keyboard

**$3799**

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- 32X Max^ Variable CD-ROM Drive
- Turtle Beach Montego A3D Sound Card
- ACS-495 Full Dolby Surround Sound Speakers with Subwoofer
- Iomega Zip 100MB Internal Drive
- Dell Comfort Key Keyboard

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- 1000LS 17" (15.9" vis) Monitor
- STB nVidia 4MB 3D AGP Video Card
- 2X DVD-ROM Drive and Decoder Card
- Turtle Beach Montego A3D Sound Card
- ACS-295 Speakers with Subwoofer
- Iomega Zip 100MB Internal Drive
- Dell Comfort Key Keyboard

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**Reference the appropriate order code to r**

**°Personal leasing arranged by Dell Financial Service independent entity, to qualified customers; amount of lease payments above based on 36-month lease. A monthly lease payments exclude taxes which may example, Hartford City, IN sales tax: ø$7.07/month); cost due with first payment; no security deposit r subject to credit approval and availability. Lease term to change without notice.**

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### DELL POWEREDGE 2300 SERVER *NEW* 400MHz PENTIUM II PROCESSOR (DUAL PROCESSOR/RAID CAPABLE)

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- Microsoft Windows NT Server 4.0 (10 Client Access Licenses)
- Internal Hard Drive Bays to Support 4-1.6" or 6-1" Drives
- 3-Year NBD On-site$^{\Delta}$ Service
- 7x24 Dedicated Server Hardware Technical Telephone Support

**$4999**

Business Lease$^{\Diamond}$: $184/Mo., 36 Mos.
Order Code #250603

### DELL POWEREDGE 2300 SERVER *NEW* 333MHz PENTIUM II PROCESSOR (DUAL PROCESSOR/RAID CAPABLE)

Common features listed above plus:

- 64MB ECC SDRAM
- 4GB Ultra2/Wide Hard Drive (Hot-Swap Optional)
- Internal Hard Drive Bays to Support 4-1.6" or 6-1" Drives
- 3-Year NBD On-site$^{\Delta}$ Service
- 7x24 Dedicated Server Hardware Technical Telephone Support

★ *Add a 333MHz Pentium II Processor, $1099.*

**$3299**

Business Lease$^{\Diamond}$: $121/Mo., 36 Mos.
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